



US Army Corps  
of Engineers  
Baltimore District

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# DESIGN CRITERIA AND SPECIFICATIONS

## Repair Steam Sterilization Plant

## FORT DETRICK, MARYLAND

REQUEST FOR PROPOSAL.: W912DR-22-R-0003

DATE: November 2022

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CHAPTER 1  
Project Description

## 1.0 PROJECT DESCRIPTION

The scope set forth in this Request for Proposal ('RFP') is for the preparation of a Full Criteria Design Build RFP (per UFC 1-300-07A) for acquisition by U.S. Army Corps of Engineers (USACE) providing a new continuous flow effluent decontamination system ('EDS') and associated building and infrastructure modifications to be located in Building 8100, Room 1SA202 within the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) at Fort Detrick, Maryland.

Building 8100 is also known as the 'USAMRIID Replacement' project. The new EDS shall be dedicated to the processing of the containment area effluent, queue storage, solids separation and thermal decontamination of all of the Building 8100 effluent flows from the BSL-3E and BSL-4 research areas, in order to support the release downstream of the EDS system of sanitary waste in a safe and fully compliant manner.

The effluent piping connections shall be rerouted to the new EDS in lieu of their current connections to the adjacent Building 8150 SSP ('Steam Sterilization Plant'). Building 8150 was intended to serve the Building 8100 EDS loads; however, effluent from Building 8100 active biocontainment research spaces has not flowed to Building 8150, and the system in Building 8150 has not been active.

Over the past four years, the government has completed multiple studies to determine the present course of action; the location of the SSP within Building 8100. The current planning has been revised to relocate the EDS process to Building 8100, and revise the EDS technology to continuous flow thermal decontamination within Building 8100. The EDS construction activities are planned to occur subsequent to the completion of the Building 8100 construction, commissioning, and nominally coincident with CDC certification and other transition activities.

### 1.1. OBJECTIVES

Project objectives are communicated through these RFP materials, and this RFP describes the overall process, process control and monitoring, as well as Architectural, Engineering and Interior Design requirements of the design-build execution, as well as critical materials, systems arrangements, and finishes for this Steam Sterilization Plant (SSP) Replacement Project. Brief descriptions of the program space types are also provided.

Requirements stated in this contract are minimum capabilities, and the requirements are set forth as critical. All work, both within the EDS manufacturers contract limits, and in any way associated with the Architecture, Engineering, or design within this RFP, must deliver extreme levels of reliability, elimination of potential points of failure, standby units, components, and pathways to provide ready alternates during upset conditions. It is essential that thoughtful design and construction provide convenient and efficient serviceability of the systems and supporting infrastructure.

Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Further, the OFFEROR is encouraged to seek solutions that shall expedite construction (panelization, modularity, pre-engineered or factory fabricated assemblies) and shorten the schedule. The Government shall emphasize funding allocations into elements which enhance functional/operational requirements. Materials and methods should reflect these required outcomes.

### 1.2. SECTION ORGANIZATION

This Section is organized under 6 major chapters.

Chapter 1 – Provides an overview of the project objectives, requirements, and reinforces essential outcomes set forth throughout the RFP.

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Chapter 1  
Project Description

Chapter 2 - Describes scope of the project.

Chapter 3 - Describes site analysis and conditions.

Chapter 4 - Lists applicable industry and government design criteria; Chapter 4 is not an all-inclusive list. Other industry and government standards may be submitted to USACE for approval to be used where the design and construction outcome is determined by USACE to enhance the project, unless they conflict with those listed.

Chapter 5 – Provides functional requirements of the new spaces. This section provides a general overview of the new design spaces and their function.

Chapter 6 - Contains Army Standard and Specific Design Criteria for this project. Criteria in Chapter 6 follows industry standard ASTM Uniformat II.

Appendixes – Provides additional supporting information, documents and drawings to supplement the narratives in Chapter 1 through Chapter 6.

All of the material cited above, provided in this request for proposal, and cited as reference codes, standard and guidelines is fully incorporated within the project requirements. If the proposing entity believes there are competing or conflicting requirements, they shall submit those to USACE for clarification; in the absence of a request for clarification the more stringent requirement in alignment with this RFP as determined by USACE shall govern.

-End of Section-

## CHAPTER 2

### Scope



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### **2.0 SCOPE**

The new SSP (Steam Sterilization Plant), is to be designed, constructed, and commissioned to provide the capability to deactivate all of the liquid waste solely coming from the U.S. Army Research Institute of Infectious Diseases (USAMRIID) Building 8100 located at the Ft. Detrick, Maryland army base. The Building B8100 SSP is to be designed to replace the existing Building 8150 function, to provide a new continuous flow effluent decontamination system ('EDS') with all associated utilities, piping, equipment and components necessary. The new EDS system shall be located at Ground level within the existing non-occupied Room 1SA202. The EDS shall be dedicated to process and deactivate all of the liquid waste coming from Building 8100 (upon completion of construction, commissioning, and CDC certification) for the BSL-3E and BSL-4 Select Agent work within Building 8100, only. The effluent flows are to be decontaminated and released to the Fort Detrick sanitary waste system. To date, Building 8150 is not operational, and therefore has required the government to consider other options to provide effluent steam sterilization capacity for Building 8100. Over the past four years the government has completed multiple studies to determine the present course of action; to locate the new SSP within Building 8100. Building 8150 decommissioning, repair and operation is not within the scope of this project.

The project includes a dedicated Mechanical, Electrical and Plumbing system to fully support the new EDS system. The SSP MEP system shall not be integrated with the existing whole Building 8100 MEP system. Additional support systems include electrical service, security, lighting, fire protection, building management system communications and supply water for the EDS equipment. Minimum site disturbance shall be needed to provide a construction entrance to the new EDS area, within level 01 of Building 8100. The design build contractor is to provide a design that is in compliance with Department of Defense (DoD) Minimum Antiterrorism for Building standards. Incorporate Cyber Security measures in accordance with UFC 4-010-06. Facilities are to be provided for a minimum life of 50 years in accordance with DoD's Unified Facilities Criteria (UFC 1-200-02) including energy efficiencies and integrated building systems. All structures must comply with the UFCs, Federal, State, installation and local standards. Where conflicts exist between the standards, the most stringent requirements shall govern for the Building 8100 - SSP (Steam Sterilization Plant).

A new continuous flow steam sterilizer plant is to be constructed within the existing Interstitial Pipe Utility space within the non-occupied Room 1SA202. A good portion of the existing utilities within the space shall need to be removed and/or relocated to provide proper clearance for the new EDS system. Include all of the necessary utilities to perform decontaminations on the effluent piping, valves or associated components. The valves shall have the capability to sterilize in place, a dedicate steam line and condensate line shall be tied into each port of the piping system or EDS components. Valves carrying BioWaste must be full port valves, and all components including valves and piping must be serializable in place with piped steam (use of hoses for steam is not acceptable.) Further definition of the EDS system requirements for new utilities, piping requirements, valves and associated components are described in greater detail in Chapter 6 of this RFP proposal, Clear maneuvering space is to be provided to initially install the new equipment, allow for maintenance and replacement of equipment in the future. The specific intent of the project is to replace the function of the Building 8150 EDS system and provide a self-sustained EDS system within Building 8100. The new EDS system shall be comprised of Storage Tank Vessels, Solid Removal/Filtration System, Continuous Process Units and additional support equipment. The existing concrete floor at the tank and filtration skid area is to be removed and replaced with a new reinforced concrete slab and footings to support the new equipment. The lowered floor area shall provide a spill containment area in case of an accidental spill. The new reinforced concrete floor and support piles to be demolished and constructed from within the building. Existing effluent piping from above is to be removed and relocated to discharge directly into the new EDS system. New mechanical, electrical and plumbing systems are required to support the new EDS system to be installed within the Room 1SA202.

## 2.1 PROJECT DESIGN

Provide overall project design per Section 01 33 16.00 10, Design Data (Design After Award).

### 2.1.1. SITE DESIGN

The project site is located at Ft. Detrick army base, within the USAMRIID B8100 building. Building 8100 is currently in construction and shall be fully completed and commissioned prior to the start of the new EDS system work. The project design, construction and construction schedule must consider current security procedures and time to enter the Ft. Detrick base complex. Additional security measures are required to enter the secured area leading to the USAMRIID Building 8100 site area. Minimal site scope work is anticipated for this project. Upon construction completion, the site is to be returned to the current original state, unless otherwise noted on the documents.

### 2.1.2. BUILDING DESIGNS

The Contractor and Designer of Record must be responsible and provide oversight, inspection and overall project coordination throughout. Design and construction approvals are required through review, comment, resolution, and concurrence by Government. All structures are to be designed and constructed to comply with UFC 3-301-01 "Structural Engineering" and other criteria listed in Chapter 4.

Design Submittals must be in accordance with Design Submittal Procedures in the Specifications, and other sections of this RFP. Delegated designs and proprietary materials specified in design documents must comply with DoD regulations.

### 2.1.3. TECHNICAL AND DESIGN REQUIREMENTS FOR ROOMS, PRODUCT, MATERIALS, AND FINISHES.

For technical and design requirements of rooms, product, materials, and finishes refer to Chapter 6. For room finishes, refer to Room Data Sheets, Appendix B.

### 2.1.4. INTERIOR DESIGN

Excellence in design is one of the primary objectives for maximizing efficiency towards mission objective. Reaching this goal requires a commitment for a level of quality that includes a coordinated relationship of interior design with building design, as well as details of design that affect efficient use of facilities. Quality interior design is value added to a project as it vitally improves facility operating efficiency, attractiveness, livability, functionality, life-cycle economics, and productivity.

### 2.1.5. FURNITURE, FIXTURES & EQUIPMENT (FF&E)

Furniture, Fixtures and Equipment (FF&E), defined as all movable / re-locatable property and equipment within a building, room, or space, shall not be part of the project scope.

Procurement and installation of FF&E is NOT included in this contract. With separate funding, the Government shall procure, and installed FF&E under a separate contract. The Contractor shall accommodate that effort with allowance for entry of FF&E vendor/installer onto this project site at the appropriate time to permit completion of installation for a complete and usable facility coinciding with the Beneficial Occupancy Date (BOD). The furniture vendor/installer contract shall include all electrical pre-wiring and whips for final connection to the building electrical systems. However, the Contractor shall make final connections to building systems under this contract. Furthermore, the General Contractor shall provide all Information/Technology (IT) wiring (i.e. LAN, phone, etc.) up to and including faceplates. The Contractor shall perform connections for all freestanding systems furniture, desktops, and equipment as applicable,

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with services to install cable and face plates in coordination with the FF&E vendor/installer to accomplish installation at the appropriate time, along with final IT connections to building systems under this contract.

The Government reserves the right to change the method of procurement and installation of FF&E to be Contractor Furnished/Contractor Installed (CF/CI). CF/CI furniture shall require competitive open market procurement by the Contractor using the Furniture, Fixtures, and Equipment (FF&E) package developed.

Preliminary FF&E information, including dimensions and sizes, are provided on Room Data Sheets (refer to Appendix B). Scheduled items of FF&E are not considered an all-inclusive list.

### **2.1.6. OPERATIONS & MAINTENANCE REQUIREMENTS**

DB Contractors are directed to refer to Appendix P of this document for outline Operations & Maintenance (O&M) requirements for the facility and equipment represented in this RFP. Bidders are invited and encouraged to develop bid OPTIONS for the DB Contractor to operate and maintain the new EDS and all other systems within the EDS area for a duration of five (5) years after Building Occupancy Date (BOD). Each year shall be identified as a separate option. (i.e Year 1, Year 2, Year 3, Year 4, Year 5).

### **2.2 AMERICANS WITH DISABILITIES ACT (ADA) / ARCHITECTURAL BARRIERS ACT (ABA)**

Project designs shall achieve full compliance with the Architectural Barriers Act (ABA) as required by federal law. The Architectural Barriers Act (ABA) contains scoping and technical requirements for accessibility to sites, facilities, buildings, and elements by individuals with disabilities. The ABA requirements are to be applied during design for new construction, additions, alterations, and lease of sites, facilities, buildings, and elements to the extent required by regulations issued by Federal agencies under the Architectural Barriers Act (ABA). Due to the type of work that is conducted in the SSP area and the requirement for protective gear to be worn during hazardous conditions, an exemption has been provided for the facility that does not required the space to be fully compliant. Where ADA requirements can be achieved without compromising the design then ADA standards to be provided.

### **2.3 ANTITERRORISM AND FORCE PROTECTION REQUIREMENTS (AT/FP)**

The project shall meet requirements of UFC 4-010-01. The facilities shall meet minimum building setback from installation boundaries. This project is unique in nature to Force Protection Requirements. These facilities require vehicle access up to the face of the building. Special attention shall be paid to the UFC. Once the contract is awarded, the Contractor shall coordinate Force Protection considerations while developing site layout with the Baltimore District Design Branch Force Protection, POC Ben Wible at 410 962-6713 and the Installation Security Office.

Exterior site features such as dumpsters and mechanical features shall be sited as per the UFC and other security measures shall also be considered for the design such as protective bollards, etc.

### **2.4 MRDC NON-OFFICIAL VISITS - FOREIGN NATIONAL VISITORS**

USAMRIID policy for processing Non-Official Foreign National (FN) visit requests within the U.S. Army Medical Research and Development Command (USAMRDC) is defined in Appendix M - MRDC Non-Official Visits. The official USAMRIID Policy 7 document "MRDC Non-Official Visits - Foreign National Visitors" with an administration revision date of 02 July 2019, is provided in Appendix M. The document applies to Non-Official FN visitors, which are individuals who work for a private organization and are not officially representing their government during their visit, thus not submitting an official government-to-government visit request. This policy does not apply to any individual working directly for, or serving as a representative of, a foreign federal, state, or local government organization. Such personnel are required to submit an

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official government-to-government visit request in the Foreign Visits System via their embassy to the U.S. Any USAMRDC Foreign Service National (FSN), does not require submission of a visit request.

All visitors, contractors, sub-contractors, suppliers and vendors entering the USAMRIID site are to adhere to the Foreign National Visitors requirements.

### **2.5 CYBERSECURITY**

All control systems (including systems separate from the energy management and control system) must be designed, acquired and executed in accordance with UFC 4-010-06 Cybersecurity of Facility-Related Control Systems and as required by individual Facilities Engineering Command (FEC) or Installation implementation policy.

ICS Security Controls located in NIST 800-82, Appendix G, Table G-1 must be incorporated. The project shall be designed using UFGS 25 05 11 Cybersecurity of Facility-Related Control Systems and 25 10 10 Utility Monitoring and Control System (UMCS) Front End and Integration. For project purposes, UFGS 25 05 11 and UFGS 25 10 10 shall provide the specifications and requirements of the Effluent Decontamination System (EDS) and its associated Human Machine Interface (HMI).

The Points of Contact to be utilized in SECTION 25 05 11 are:

Daniel Shepard, Chief, Cybersecurity & IT Branch, USACE Huntsville, (256) 895-1178,  
daniel.a.shepard@usace.army.mil

Cybersecurity requirements shall be incorporated into project facility control systems identified in:

C10, PROCESS – EFFLUENT DECONTAMINATION SYSTEM

D10, PLUMBING

D20 FIRE PROTECTION

D30, HVAC

D40 CONTROLS

D50, ELECTRICAL, LIGHTING, FIRE ALARM, AND INFORMATION TECH

D60, ELECTRONIC SECURITY SYSTEM

For further information regarding cybersecurity of facility-related control systems, refer to Chapter 6 Section D70 FRCS CYBERSECURITY.

### **2.6 WORKFLOW PROCESS**

#### **2.6.1 OPERATION**

The new USAMRIID building operates on a 24-hour a Day schedule, with a typical schedule of seven days per-week. Construction of Building 8100 shall be completed and shall not be fully functional at the start of the new EDS SSP project. The Contractor shall be responsible for assuring uninterrupted operational performance of USAMRIID Building 8100 throughout the project duration. Currently, USAMRIID Is not a fully operational facility with functioning lab and toilet facilities. Presently, within Building 8100 the only effluent processed through the building drainage system is the periodical tested of the existing drains using

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limited potable water. No chemical or biological waste has been or will be processed through the existing drain lines until the building is fully completed, commissioned, and validated. The current building is connected to the existing site sanitary system and shall remain on the existing site sanitary system until the new EDS system is fully functional, commissioned and validated.

The new SSP EDS project shall be designed for operating on a 24-hour a Day schedule, continuously, every day. The base has a 2 day maintenance shut down once a year. The EDS system and EDS MEP systems are to be designed to remain fully functional during this period. The facility may reduce personnel and use during the shutdown period.

## 2.6.2 STAFFING/OCCUPANCY

The number of occupants specified in the RFP are identified for programming purposes. Determine occupancy used to design building features, such as structural, egress, and plumbing fixtures as required in applicable building or life safety codes.

## 2.7 SPECIAL DESIGN CHALLENGES

Functionality of Building 8100 must be maintained during construction. The current building is connected to the existing site sanitary system and shall remain on the site sanitary system until the new EDS system is fully functional, commissioned and validated.

Access for construction workers and supply vehicles needs to be understood prior to submitting a bid. A Pre-Bid meeting is to be provided with bidding contractors and the Ft Detrick garrison to provide security logistic information of the Ft Detrick site security requirements. It is the contractor's responsibility to determine the requirements and schedule the necessary time to provide access for personnel and supplies to the project site. GOVERNMENT-FURNISHED GOVERNMENT INSTALLED EQUIPMENT (GFGI)

The Contractor must coordinate with the Contracting Officer for requirements of GFGI items scheduled, and provide the design and deliver suitable structural support, brackets for projectors/VCRs/TVs, with all utility connections, and space with required clearances, for all GFGI items. Fire extinguishers, fire extinguisher brackets, and cabinets are Contractor furnished and installed CF/CI. All computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGI. For scheduled GFGI items, refer to the Room Data Sheets (refer to Appendix B).

## 2.9 BUILDING COMMISSIONING

The Contractor shall provide commissioning to meet requirements identified in Section 01 91 00.15 Total Building Commissioning, and UFC 1-200-02 High Performance and Sustainable Building Requirements.

-End of Section-

CHAPTER 3  
Site Analysis

### 3.0. SITE ANALYSIS

Civil, establishes and describes the relevant design scope and criteria for accessibility, protection, demolition, construction and restoration of improvements associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. Civil components associated with proposed improvements include documentation and condition of existing features prior to construction, protection of existing improvements, coordination of new equipment access into Building 8100 and the restoration of areas disturbed during installation. Limited site work is anticipated but should consist of all aspects of a complete project site. This includes site planning and design of any new or temporary site features including (utilities, buildings, roads, parking, walkways, fencing, demolition, earthwork, storm drainage, signage, landscaping, force protection, stormwater management and erosion and sediment control, and obtaining necessary permits. Architectural and Structural coordination will be required for building, tunnel and vault penetrations.

#### 3.1. EXISTING SITE DESCRIPTION

USAMRIID is a tenant on the Fort Detrick campus that performs research and development in biosafety in SSP Building 8100. Fort Detrick is a secured facility situated between Baltimore, MD., (46 miles) and Washington, D.C., (45 miles) within Frederick County, MD. Major highways that access the county are 1-70, I-270, U.S. 15, U.S. 40, U.S. 40A and U.S. 340. Frederick County is easily accessible by automobile, air, train, and motorcoach. Reagan National, Dulles International and Baltimore/Washington International airports are less than an hour from Frederick, which is also served by Frederick Municipal Airport.

The project site is located within a primary controlled secured perimeter and a secondary controlled site within the Fort Detrick Installation. The project site contains a newly constructed Building 8100, newly constructed utilities and new site improvements including (building, roads, parking, walkways, fencing, stormwater management, landscaping, etc.) associated with Building 8100. All site utilities are newly installed and have been designed to handle operations to and from Building 8100. Topographic information and drawings of SSP Building 8100 and immediate surrounding area are provided in Appendix F. The DB Contractor is required to conduct an actual field survey and verify all topographic information and the verified topographic survey shall be included in the design plans. Prior to starting work, it is the DB Contractor's responsibility to physically verify the location of all existing utilities and obtain all additional survey data required to provide a quality final design. The existence, size and/or location of the utilities are not guaranteed by the information provided; the DB Contractor shall verify prior to construction. Any provided subsurface data and information is only for the DB Contractor's information and is not guaranteed to fully represent all subsurface conditions. Fort Detrick shall not be responsible for any interpretation or conclusion by the DB Contractor drawn from the data or information.

The soil at the project site consists of residual soils over weathered limestone. The soil thickness is highly variable due to the elevation of the bedrock surface (pinnacled rock surface) which ranges between 5 to 23' below existing grade. The existing soil consists primarily of clays and silts that were not recommended as building fill material.

#### 3.2. CONSTRUCTION PHASING, STAGING, AND CONTRACTOR ACCESS

All Fort Detrick Installation buildings and surrounding site amenities including roadways, hardstand areas, parking, and walks shall remain fully operational during construction. The contractor shall consider any phasing aspects in the new design in order to maintain all operations of the existing facility, including but not limited to pavement construction, utilities, fencing, earth moving and other equipment operations, etc.

The Contractor staging area shall be contained within the project limits and shall not impact existing building operations. Security of the site is the contractor's responsibility and will be required to design, construct and maintain a secondary controlled perimeter in order to isolate all construction activities associated with SSP

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Site Analysis

Building 8100 to ensure safety to staff (i.e., safety fence, security fence, covered walks, etc.). There will be allowed only one point of access to the project site. DB Contractor will be responsible to maintain security of this single point of access. Any areas disturbed by the Contractor's staging areas that are not part of the new development shall be stabilized against erosion and restored with top soil and seeded per landscape paragraphs herein and in accordance with Maryland MDE requirements. Any pavement areas damaged during construction will be repaired at the Contractor's expense to the satisfaction of the Contracting Officer. Staging of equipment, soil stockpile, and other material shall not be placed within 5 feet from any existing tree drip line. All flammables must be stored within the designated contractor laydown area.

All Contractor access onto Fort Detrick shall be coordinated with and approved by the Fort Detrick Contracting Officer. All DB Contractor and Sub-Contractor related vehicles shall strictly adhere to the approved construction access route. Ingress and egress for all persons and vehicles must be thru the Nallin Farm Gate located on Veterans Drive just off the Opossumtown Pike. Nallin Farm Gate is a secured and guarded access with limited radius and width. All persons entering thru Nallin Farm Gate are required to have Pre Security Clearances (Vetting for Contractors is recommended) and will be subject to inspections and verification. Inspection and verification wait times vary based upon volume, time of day and use of consistent drivers. Wait times should be estimated as 20 minute minimum to a 45 minute maximum wait. Adjacent bypass lanes are available without height clearances or restrictions for oversized vehicle delivery but must be coordinated with the installation.

DB Contractor ingress and egress within the site including personnel and vehicles, will be limited to Campus Drive, Porter Street, Ditto Avenue in order to access existing parking area off of Bullene Drive. All personnel will be required to access Building 8100 protected perimeter thru security building 1416 (approximately 1400 feet from parking area). Entrance to building 8100 will be via gated access at the Building 1416 RIID Entry Control Point, access corridor and adjacent fire lane. Fire lane must remain open and operational at all times. There shall be no idling of trucks at any time on the site south or west of Building 8100.

Equipment and material handling vehicles will be limited to existing access onto the site via Campus Drive, Porter Street, Veterans Drive and then thru a protected perimeter at Building 1416 RIID Entry Control Point. Once thru the access corridor onto the project area of SSP Building 8100, all equipment and material handling vehicles will be able to access a secure laydown and staging area adjacent Porter Street. All traffic must go directly to contractor laydown area or Building 8100. Delivery vehicles will only be permitted inside RIID security fence for the period of delivery. DB Contractor shall coordinate all delivery routes with other traffic required at all times. No vehicle shall be left unattended. Deviation from these routes will incur maneuvering and height restriction and will require coordination with the installation.

It will be the DB Contractor's responsibility to confirm all routes of travel for compliance regarding, but not limited to, times of travel, size and weight limitations and neighborhood restrictions. The DB Contractor will confirm compliance for all vehicles, equipment and materials prior to entering or exiting. In the case of noncompliance or oversized loads, it will be the DB Contractor's responsibility to notify the installation in advance. It will be the DB Contractor's responsibility to address any noncompliance with an alternative solution, including design, approval, construction, and restoration to original conditions with no additional fee.

It is the DB Contractor's responsibility to provide traffic control at all locations for construction activities that impede natural pedestrian or vehicle flow patterns on and off site. An emergency access gate at the end of Sultan must be clear of obstructions and be accessible to Fort Detrick Fire Department at all times. A Traffic Control Plan will be prepared, submitted, and approved as part of that responsibility.

### **3.3. DEMOLITION**

The Contractor shall be responsible as part of the design to prepare the site for construction of new site features or to backfill turf areas with proper grading and drainage. Some minor demolition and temporary



protection may be required for this project. A portion of Building 8100 wall will be removed allowing construction access into the building.

All existing utilities on the site shall be protected during the demolition and construction process. Any damage shall be immediately repaired to the satisfaction of the Contracting Officer in accordance with the utility owner's requirements at the Contractor's expense. There are no permanent site utility improvements anticipated as part of this project. A detailed demolition plan shall be developed and submitted per Section 01 33 16.

All materials shall be disposed of outside the limits of Government controlled lands. Disposal shall be in accordance with the federal, state, and local regulations. The Contractor shall notify the Contracting Officer if any material to be disposed of is found to contain hazardous, toxic, biological, or radiological substances. Rubbish and debris shall be removed from Government property promptly to avoid accumulation at the project site.

### 3.4. NEW CONSTRUCTION SITE LAYOUT GUIDELINES

The finished project will consist of the Contractor designed optimum layout of all required features, including protection, circulation and access and equipment storage areas. The site design will provide for appropriate vehicle access around each facility. Sidewalks and clear areas around each facility will meet customer emergency requirements. An Emergency Preparedness and Protection Plan (EPPP) will need to be prepared, reviewed and approved by Contracting Officer prior to construction. The EPPP must address safety, fire protection, environmental/sustainability concerns, hazardous and flammable liquid storage and approved emergency access route and procedures if case of emergency.

Access and site drawings were developed by the Government in conjunction with the Garrison, facility users, and Center of Standardization, and are provided as bridging documents in appendix G. These drawings are provided for information reference only, and shall be modified as required during design development to incorporate the requirements included in this RFP.

#### 3.4.1 EXISTING FACILITIES

The project site contains a newly constructed Building 8100, newly constructed utilities and new site improvements including (building, roads, parking, walkways, fencing, stormwater management, landscaping, etc.) associated with Building 8100. All site utilities are newly installed and have been designed to handle operations to and from Building 8100. Topographic information and drawings of SSP Building 8100 and immediate surrounding area can be made available.

There are no new site improvements anticipated as part of this project. It will be the DB Contractor to protect, utilize and restore existing site features to original conditions upon completion of the project.

An existing fire lane along the south side of Building 8100 is anticipated to be used as the major means of ingress and egress to the building and should be protected. Existing fire lane to remain operational at all times during construction and is not to be blocked by equipment, storage of material or construction vehicles. If Fire Lane needs to be temporarily blocked due to construction or deliveries in the Fire Lane, the contractor shall coordinate the Fire Lane closure with the Fort Detrick Fire Department through the COR.

DB Contractor is responsible to verify, document and notify Contracting Officer of any existing site feature damaged prior to construction.

### 3.4.2 ANTITERRORISM AND FORCE PROTECTION

Antiterrorism and Force Protection meeting requirements of UFC 4-010-01 as installed as part of the original Building 8100 project shall be protected and maintained during construction activity. It will be the DB Contractors responsibility to restore any Antiterrorism and Force Protection removed or damaged to the buildings original condition and design. The unobstructed space requirements shall be adhere to during construction for potential explosive concealment opportunities around the facility; dumpsters will be placed outside of the unobstructed space.

### 3.4.3 GRADING

All grading shall be in conformance with applicable standards and be kept to a minimum and under 5,000 s.f. Disturbances over 5,000 s.f. will require additional permitting thru MDE.

Temporary or final grading shall be designed to drain away from Building 8100 and conform to existing drainage patterns as not to obstruct water flows to existing inlets.

Blasting will not be permitted. Borrow and select fill shall come from off-base sources.

### 3.4.4 UTILITIES

There are no permanent site utilities anticipated as part of this project.

It is the DB Contractor's responsibility to maintain uninterrupted utility service. If service is to be interrupted the DB Contractor is responsible for preparing, submitting and obtaining approvals from installation and jurisdictional agencies (City of Fredrick water) prior to commencement of work. Alternative service prior to disconnection of existing service in order to maintain uninterrupted service must be provided. The DB Contractor is responsible for providing temporary utility services (electric, sanitary, lighting etc.) for their own use when services are not available or made available. Preserve all existing utilities within existing project location that do not interfere with the siting of new project elements for the proposed project.

Abandonment of existing utilities is not anticipated as part of this project, however, in the case of abandonment of utility systems, shall be done in a manner that conforms to applicable codes and regulations, removes their presence from the ground surface and clearly indicates that they have been abandoned. Utilities shall not be abandoned in place underneath or within 10 feet (3.0 m) of any new facilities. All conduits to be abandoned shall have wiring removed. All piping to be abandoned shall be removed. Remove existing utility structures to 3 feet (900 mm) below existing or new adjacent grade, whichever is greater.

### 3.4.5 EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT

Since there is no earthwork, clearing or grading of land associated with proposed site improvements, Erosion and Sedimentation approval from State of Maryland is not anticipated. However, if there is minimal disturbance and MDE permits are not triggered based on the Limit of Disturbance (LOD) requirements, it is the DB Contractor's responsibility to become familiar and comply with all regulations associated with earthmoving activities and the Maryland Erosion & Sediment Control Guidelines for State & Federal Projects for E & S control and stabilization, published January 1990 and revised January 2004. Note that clearing or grading activities that disturb less than 5,000 square feet of land area and involve less than 100 cubic yards of earth movement are exempt from the provisions of the Guidelines; all other construction activities shall meet the requirements of the Guidelines.

Earth disturbance during demolition or construction activities may cause accelerated erosion. A requirement for reducing accelerated erosion is the preparation and implementation of an Erosion and

Sedimentation Control Plan. An Erosion and Sedimentation Control Plan must be prepared by a professional qualified to perform such task and then implemented throughout the project performance period. The DB Contractor shall develop and submit Erosion and Sedimentation Control documents, if required, based on their design, to all governing bodies with jurisdiction and obtain and secure all necessary approvals from governing bodies with jurisdiction.

The DB Contractor shall at a minimum, perform weekly inspections and maintenance in order to maintain the effectiveness of the erosion and sediment control measures and shall inspect and maintain the erosion and sediment control measures after any runoff producing event. The DB Contractor shall remove erosion and sediment controls only after all upstream areas have been fully stabilized and accepted by the State or Local Inspector as applicable.

### 3.5. LANDSCAPE DESIGN

#### 3.5.1 OVERALL LANDSCAPE DESIGN

The DB Contractor will be responsible to preserve and protect existing trees, lawn, utilities and existing hardscapes (including fire lane) to the greatest extent possible. Removal of existing features will only be to the extent required for construction. All grubbing and clearing residue, demolished material, rubbish and debris generated by this project shall be hauled off-site and off station by the DB Contractor. Burning will not be allowed. For lawn, provide 4" of topsoil, seed, lime and fertilizer and stabilize for all existing grass areas disturbed by the DB Contractor.

#### 3.5.2 TREE PRESERVATION AND REFORESTATION

Due to the location of operations, tree preservation and reforestation is not anticipated except for a tree located adjacent contractor trailer/material laydown area. Every attempt shall be made to preserve and protect the natural site(s) and existing plants shall be disturbed as little as possible to create a natural environment. The contractor shall be responsible for protecting existing plantings during construction. For tree preservation, root pruning shall be utilized when excavating within an existing tree's root zones and drip lines. Vehicles or equipment may not be parked under trees to be preserved (on or offsite). As part of his/her tree preservation plan, the contractor shall employ an International Society of Arboriculture (ISA) certified arborist. The contractor, per the guidance and direction of an arborist, shall provide tree protection and root pruning for existing trees within the limits of construction. Tree protection shall be set up and root pruning performed prior to commencement of construction activities and maintained throughout project; ensuring that existing trees to remain shall be properly safeguarded against damage and any necessary root pruning performed to ensure survivability of trees. The project arborist shall survey/inspect all existing trees to remain and if any existing trees that are designated to be saved are found to be dead, structurally unsound and/or deemed a safety hazard, the contractor shall remove tree(s) in its entirety with approval of the contracting officer. All pruning debris generated shall be disposed of in a proper manner.

The contractor shall replace any trees that are damaged and/or killed during construction. If the need arises, trees that are damaged and/or killed shall be replaced, 2 new trees for every 1 damaged and/or killed. Shrubs shall be replaced, 1 new shrub for every 1 damaged and/or killed. Replacement trees and shrubs shall be replaced in kind unless instructed otherwise by the COR and/or Fort Detrick DPW. Planting locations for replacement trees/shrubs shall be coordinated with COR and Fort Detrick DPW.

#### 3.5.3 ENVIRONMENTAL

Due to location and limited site work, encroachment of environmentally sensitive areas are not anticipated. However, it will be DB Contractors responsibility to become familiar and comply with all regulations and submission in order to obtain approvals that may arise from neighborhood, county, state and federal agencies.

**Endangered Species:** The federally endangered Indiana bat if present on Fort Detrick must be considered in all actions. Projects involving ANY habitat modification (e.g., vegetation removal) must be addressed by Fish and Wildlife Management Program. In general, no trees greater than 4-inches (diameter breast height) may be cut from the October 15<sup>th</sup> to April – 15<sup>th</sup> to avoid any direct adverse effects to the Indiana bat. Clearing of natural vegetation (e.g., shrubs and trees) less than 4 inches (diameter breast height) should typically occur between August 1 - April 15 to minimize the impact to migratory birds and to maintain foraging areas for bats. The contractor (and all subcontractor) shall be responsible for coordination with Endangered Species Act and all other applicable laws and regulations pertaining to wildlife. Overall the contractor (and all subcontractors) shall minimize interference with, disturbance to, and damage to plants, fish, wildlife, and their habitats on and adjacent to the project area.

If any bats are discovered during the demolition or repair of buildings (to include work such as complete and partial building demo, removal/replacement of roofs, siding, etc.), all work must cease and Fish and Wildlife Management Program (772-9636 or 772-4999) must be immediately contacted.

#### 3.5.4 VEGETATIVE STABILIZATION

The Contractor shall include provisions for temporary seeding and permanent vegetative stabilization of all disturbed turf areas not paved or otherwise landscaped. Temporary and permanent seeding guidelines per Maryland MDE standards and specifications apply for this RFP. Planting and maintenance of permanently seeded areas shall be according to the specifications and per the seed supplier's recommendations. Planting information for seed shall be provided in the form of specifications. Prior to installing seed, seed shall be available for inspection by Fort Detrick DPW and the COR upon delivery. The contractor shall make arrangements for Fort Detrick DPW and the COR to visit project sites. The contractor shall propose a date and once a date is agreed upon, Fort Detrick DPW and the COR shall be notified a minimum of one week (7 days) before the proposed planting days and time. Fort Detrick DPW and the COR reserve the right to refuse seed that is in poor health and not as specified.

#### 3.5.5 UPDATED TURFGRASS (TEMPORARY AND PERMANENT SEEDING) SELECTION

All seed selections shall be updated to reflect new and improved cultivars that are hardier and have greater pest and disease resistance.

#### 3.5.6 TURFGRASS (TEMPORARY AND PERMANENT SEEDING) ESTABLISHMENT AND WARRANTY PERIOD

All new seeded areas and sod shall be guaranteed for 12 month. All new seed furnished for this project shall have an establishment period to commence on the date that inspection shows that the furnished seed has been satisfactorily installed.

Maintenance and care shall begin immediately after new seeded areas have been installed. Maintenance of seeded areas, especially during establishment, should be included as part of 1-year warranty and performed on a regular basis (minimum frequency of monthly). Maintenance shall include but not be limited to: Watering, Weeding/Invasive Species removal, Mowing, Mulching, Debris Removal.

The establishment period shall continue for a minimum period of 12 months for all new seeded areas after date of final acceptance. During the 12 month establishment period, the contractor shall be responsible for regular watering of new and seeded areas. Regular watering is required and shall be performed on a consistent basis to ensure successful establishment of seeded areas. Allowing plant material to die from lack of regular watering because it is cheaper to replace at end of warranty period is unacceptable. A minimum 12 month guarantee shall be indicated so that any new seed planting areas which have died (or have grown in a manner uncharacteristic of its type) within the 12 month establishment period shall be replaced at the contractor's expense. Seeded areas are judged on the healthiness and fullness of the turf growth. Ninety five percent of new growth shall be present in sodded areas with minimal weed presence.

In addition to regularly performed maintenance, within 10 days prior to date of final acceptance, the contractor shall remulch all mulched areas; remove invasives/weeds/perform edging; mow all turfgrass areas; perform tree support adjustments as needed. Guarantee information shall be shown in the specifications.

### 3.5.7 INVASIVE SPECIES

Invasive species shall be removed before they become incorporated into planting areas. Extensive chemical use is not conducive to water quality improvement and wildlife habitat.

### 3.5.8 SOIL STABILIZATION

For lawn, provide 4" of topsoil, seed, lime and fertilizer and stabilize for all existing grass areas disturbed by the DB Contractor.

### 3.5.9 TOPSOIL

The topsoil (existing on-site topsoil and/or imported topsoil) shall be tested and modified as necessary to ensure soil and drainage conditions detrimental to plant growth are identified and corrected. Planting soil for turf shall be a minimum 4" depth and spread throughout all turf areas. Topsoil shall be fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, and free of subsoil, stones, clay or impurities, plants, weeds and roots. pH value shall be between 5.5 and 7.0 and organic content shall be 7 to 10 percent. Topsoil shall be as specified in specifications and shall be reused from the site as much as possible. If the stored site's topsoil is insufficient or not appropriate for the landscaping needs, additional topsoil shall be provided by the Contractor from an off-site source approved by the Contracting Officer.

Suggest that topsoil for the purpose of establishing and sustaining healthy, productive soils at the project site be addressed. Topsoil shall be fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, and free of subsoil, stones, clay or impurities, plants, weeds and roots. The soil (existing on-site topsoil and imported topsoil) shall be tested and modified as necessary to ensure soil and drainage conditions detrimental to plant growth are identified and corrected.

Topsoil shall be free of invasive plants, invasive plant parts, or seeds of invasive plants listed for the state of Maryland.

Suitable organic matter of topsoil should range from 7-10% and suitable pH should range from 5 to 7.

Subsoil acidity of topsoil should be addressed. Where the subsoil is either acidic or composed of heavy clays, ground limestone shall be spread at the rate of 4-8 tons/acre (200-400 lbs per 1000 sq ft) prior to the placement of topsoil. Lime shall be distributed uniformly over designated areas and worked into the soil.

Subsoil shall be tilled to a minimum depth of 6" before placement of topsoil.

Topsoil shall be uniformly distributed in a 4-6" layer and lightly compacted to a minimum thickness of 4".

Topsoil shall not be placed while the topsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation.

If the stored site's topsoil is insufficient or not appropriate for the landscaping needs, additional topsoil shall be provided by the Contractor from an off-site source approved by the COR.

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Prior to delivery, reports shall be provided to COR for any topsoil or backfill delivered to project site and shall include original location of material. Topsoil or backfill material is subject to inspection by the COR and Fort Detrick DPW at point of origin and source.

### **3.5.10 FERTILIZER**

If fertilizer needs to be applied for successful establishment of proposed plants and sod, only use organic fertilizer and do not apply near water, storm drains or drainage ditches. Do not apply if heavy rain is expected. Apply fertilizers only to lawn and planting areas and sweep any product that lands on driveways, sidewalks, or streets, back onto the turfgrass and planting areas.

### **3.5.11 MISCELLANEOUS REQUIREMENTS**

Requirements stated in this contract are minimums. Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Any work that is shown elsewhere in this RFP (drawings, specifications) that is not covered in the written part of the RFP shall still be the responsibility of the contractor. In addition, it shall be distinctly understood that the failure to mention specifically any work which would normally be required to complete the project shall not relieve the contractor of his responsibility to perform such work.

-End of Section-

CHAPTER 4  
Applicable Criteria

#### 4.0 APPLICABLE CRITERIA

Although a specific document version or date may be indicated, use criteria from the most current references, including any applicable addenda, unless otherwise stated in the contract or task order, as of the date of the Contractor's latest accepted proposal or date of issue of the contract or task order solicitation, whichever is later. In the event of conflict between the following; references, Applicable Military Criteria, guideline, regulation, code, requirement, local guidance, Local Instruction, or SOP then apply the most stringent requirement, unless otherwise specifically noted in the contract or task order. The version or official change to the listed criteria document shall be as of the date of the official award of the contract.

#### 4.1. INDUSTRY CRITERIA

Applicable design and construction criteria references are listed in Table 1 below. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed. References cited herein are not necessarily incorporated in their entirety. Refer to specific design requirements established in Paragraph 6 for applicability extents or limits. Refer also to Paragraph 2 for additional facility-specific applicable criteria.

Table 1: Industry Criteria

Air Conditioning, Heating, and Refrigeration Institute (AHRI)	
ANSI/AHRI/CSA 310/380	Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)
Air Movement and Control Association (AMCA)	
ANSI/AMCA 210 ANSI/ASHRAE 51-07	Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
American Boiler Manufacturers Association (ABMA)	
	Comparison of Fatigue Assessment Techniques for Heat Recovery Steam Generators
	Determining and Testing Boiler Efficiency for Commercial/Institutional Packages Boilers
	Specification Design Life Requirements and Implications Relative to Boilers



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	Steam Source Book
American Concrete Institute	
ACI 302.2R-06	Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318-14	Building Code Requirements for Structural Concrete and Commentary
ACI 355.2	Qualification of Post-Installed Mechanical Anchors in Concrete
ACI 355.4	Acceptance Criteria for Qualification of Post-Installed Anchors in Concrete
ACI 530-16	Building Code Requirements and Specifications for Masonry Structures and Related Commentaries
ACI SP-66	ACI Detailing Manual
American Institute of Steel Construction (AISC)	
AISC 201	AISC Certification Program for Structural Steel Fabricators
AISC 325	Steel Construction Manual, 15 <sup>th</sup> Edition
AISC 341	Seismic Design Manual, 2 <sup>nd</sup> Edition
AISC 360	Specification for Structural Steel Buildings

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American Iron and Steel Institute (AISI)	
AISI D100	Cold-Formed Steel Design Manual
AISI S100	North American Specification for the Design of Cold-Formed Steel Structural Members
American National Standards Institute (ANSI)	
ANSI/IEEE C2	National Electrical Safety Code
ANSI/AIHA Z9.5 2012	Laboratory Ventilation Standard
ANSI Z21.101/ CSA 8.5-2012	Gas Hose Connectors for Portable and Moveable Gas Appliances
ANSI/ASME B31.1	Power Piping for all high and medium pressure steam and pressurized condensate or return systems.
ANSI/ASME B31.9	Building Services Piping
American Society of Civil Engineers (ASCE)	
ASCE/EWRI 45-05	Standard Guidelines for the Design of Urban Stormwater Systems
ASCE/EWRI 46-05	Standard Guidelines for the Installation of Urban Stormwater Systems
ASCE/SEI 7-16	Minimum Design Loads for Buildings and Other Structures
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)	

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ASHRAE Guideline 0	The Commissioning Process
ASHRAE Guideline 1.1	HVAC&R Technical Requirements for The Commissioning Process
ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy
ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality
ASHRAE Standard 90.1	ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Standard 189.1-2011	Standard for the Design of High-Performance Green Buildings (ANSI Approved; USGBC and IES Co- sponsored)
American Society of Mechanical Engineers International (ASME)	
ASME B31 (Series)	Piping Code Series, Various Dates (Current Versions)
ASME BPVC, Section VII	Boiler and Pressure Vessel Code: Section VII, "Care of Power Boilers"
American Water Works Association (AWWA)	
	AWWA Standards: Full Set of Standards (2012 Version)
American Welding Society (AWS)	
WHB	Welding Handbook, Ninth Edition Vol.1-4; Eighth Edition Vol. 3
AWS D1.1	Structural Welding Codes – Steel (2015)

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AWS D1.8	Structural Welding Code – Seismic Supplement (2016)
ASW D9.1M/D9.1	Sheet Metal Welding Code
ASTM International	
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C1060-11a	Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM E779-10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
Builders Hardware Manufacturers Association (BHMA)	
ANSI/BHMA A156 Series	ANSI/BHMA A156 Series Standards, Various Dates (Current Versions)
Building Industry Consulting Service International	
	Telecommunications Distribution Methods Manual, 12 <sup>th</sup> Edition
	Outside Plant Design Reference Manual, 5 <sup>th</sup> Edition
Code of Federal Regulations (CFR)	
10 CFR 430	Energy Conservation Program for Consumer Products
Consumer Electronics Association (CEA)	

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CEA 709.1-C (ANSI)	Control Network Protocol Specification
CEA 709.3 R (ANSI)	Free-Topology Twisted-Pair Channel Specification
CEA 852-B (ANSI)	Tunneling Device Area Network Protocols Over Internet Protocol Channels
Illuminating Engineering Society (IES)	
IES DG-18-08	Light + Design: A Guide to Designing Quality Lighting for People and Buildings
Institute of Electrical and Electronics Engineers (IEEE)	
IEEE/ASTM SI_10	American National Standard for Metric Practice
IEEE Standard 1100	IEEE Emerald Book: IEEE Recommended Practice for Powering and Grounding Electronic Equipment
International Building Code (IBC)	
IBC-18	International Building Code (2018)
IPC-18	International Plumbing Code (2018)
International Organization for Standardization (ISO)	
ISO 6781:1983	Qualitative Detection of Thermal Irregularities in Building Envelopes – Infrared Method
Midwest Insulation Contractors Association (MICA)	
	National Commercial and Industrial Insulation Standards

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	Manual, 7 <sup>th</sup> Edition
National Association of Corrosion Engineers (NACE) International	
SP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
SP0185	Extruded Polyolefin Resin Coating Systems with Soft Adhesives for Underground or Submerged Pipe
SP0285	Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
SP0286	Electrical Isolation of Cathodically Protected Pipelines
National Environmental Balancing Bureau (NEBB)	
PST-TAB-2005	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, 2005 – Seventh Edition
National Fire Protection Association (NFPA)	
NFPA 01	Fire Code
NFPA 03	Standards for Commissioning of Fire Protection and Life Safety Systems
NFPA 04	Standard for Integrated Fire Protection and Life Safety System Testing
NFPA 10	Standard for Portable Fire Extinguishers
NFPA 13	Standard for the Installation of Sprinkler Systems

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NFPA 14	Standard for the Installation of Standpipe and Hose Systems
NFPA 24	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 25	Standard for the Inspection, Testing And Maintenance of Water- Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 45	Standard for Fire Protection for Laboratories using Chemicals
NFPA 54	National Fuel Gas Code
NFPA 70	National Electrical Code
NFPA 70E	Standard for Electrical Safety in the Workplace
NFPA 72	National Fire Alarm and Signaling Code
NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 90a	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 101	Life Safety Code
NFPA 110	Standard for Emergency and Standby Power Systems
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 291	Recommended Practice for Fire Flow Testing and Marking of

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	Hydrants
NFPA 780	Standard for the Installation of Lightning Protection Systems
Occupational Safety and Health Administration (OSHA)	
29 CFR 1926	Safety and Health Regulations for Construction
American Society of Plumbing Engineers	
ASPE	Plumbing Engineering Design Handbook
Plumbing and Drainage Institute (PDI)	
PDI WH201	Water Hammer Arrestors Standard
Precast Concrete Institute	
	PCI Design Handbook, 8 <sup>th</sup> Edition
American Conference of Governmental Industrial Hygienists	
ACGIH Industrial Ventilation	A Manual of Recommended Practice
Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)	
	HVAC Duct Construction Standards - Metal and Flexible (2005)
	Architectural Sheet Metal Manual, 7 <sup>th</sup> Edition
	HVAC Systems - Testing, Adjusting and Balancing (2002)

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Steel Door Institute (SDI)	
ANSI/SDI A250.8 (R2008)	SDI-100 Recommended Specifications for Standard Steel Doors and Frames
Steel Deck Institute (SDI)	
SDI DDM04	Steel Deck Institute Diaphragm Design Manual, Fourth Edition
SDI RD	Standard for Steel Roof Deck
SDI MOC3	Manual of Construction with Steel Deck, Third Edition
Telecommunications Industry Association (TIA)	
TIA-568 Set	Commercial Building Telecommunications Cabling Standard Set, Edition C
TIA-569	Telecommunications Pathways and Spaces, Edition C
TIA-606	Administration Standard for the Telecommunications Infrastructure, Edition B
TIA-607	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, Edition B with Addendum
U.S. ACCESS BOARD	
ADA/ABAAG	<p>Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, 2004 Version as Currently Amended</p> <p>Excluded are:</p> <p>(a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-</p>

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	<p>abled military personnel. (See Paragraph 3 for any reference to this exclusion).</p> <p>(b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively able-bodied military personnel. (See paragraph 3 for any reference to this exclusion).by</p>
ABA	Accessibility Standard for Department of Defense Facilities
CDC Requirements	
BMBL 6 <sup>th</sup> Edition	Biosafety in Microbiological and Biomedical Laboratories
National Institute of Standards and Technology	NIST SP 800-82 Guide to Industrial Control Systems
(ICS) Security	NIST SP 800-53 R4 Security and Privacy Controls for Federal Information Systems and Organizations

#### 4.2. MILITARY CRITERIA

The project shall conform to the following criteria. Certain design impacts and features due to these criteria are noted for the benefit of the offeror; however, all requirements of the referenced criteria shall be applicable, whether noted or not, unless otherwise specified herein. The version or official change to the document shall be as of the date of the official award of the contract.

Table 2: Military Criteria

LAWS, POLICIES, REGULATIONS, AND OTHER CRITERIA	
EISA07	Energy Independence and Security Act of 2007
EO 12770	<p>Metric Usage In Federal Government</p> <p>(a) Metric design and construction is required except when it increases construction cost. Offeror to determine the most cost- efficient system of measurement to be used for the</p>

	project.
EPACT05	Energy Policy Act of 2005 / Public Law 109-58
I3A	<p>Technical Criteria for Installation Information Infrastructure Architecture (I3A)</p> <p>(a) A copy of the I3A Criteria can be obtained by sending an email request to: <a href="mailto:detrickISECI3Aguide@conus.army.mil">detrickISECI3Aguide@conus.army.mil</a></p>
STIC	<p>U.S. Army Information Systems Engineering Command (USAISEC) SECRET Internet Protocol (IP) Router Network (SIPRNET) Technical Implementation Criteria (STIC)</p> <p>(a) SIPRNET may not be included in all facilities.</p> <p>(b) For those facilities designated to receive SIPRNET connectivity, this is mandatory criteria.</p>
PROTECTIVE DESIGN CENTER (PDC)	
PDC TR 06-08	Single Degree of Freedom Structural Response Limits
PDC TR 10-02	Blast Resistant Design Methodology for Window Systems Designed Statically and Dynamically, 2012
DA PAM 385-69	Department of the Army Pamphlet 385-69. Safety Standards for Microbiological and Biomedical Laboratories
DA PAM 385-10	Department of the Army Pamphlet 385-10. Army Safety Program
UNIFIED FACILITIES CRITERIA (UFC)	
UFC 1-200-01	<p>General Building Requirements</p> <p>(a) References to applicable International construction codes, such as: International Building Code (IBC), International Mechanical Code (IMC), International Residential Code (IRC), International Plumbing Code (IPC), and International Energy Conservation Code (IECC) are located within this UFC.</p> <p>(b) Always utilize the latest edition of this document, regardless of references in this RFP or in other publications.</p>

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UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 1-300-07A	Design Build Technical Requirements
UFC 3-101-01	Architecture
UFC 3-120-01	Sign Standards
UFC 3-120-10	Interior Design
UFC 3-210-10	Low Impact Development
UFC 3-220-01	Geotechnical Engineering
UFC 3-230-01	Water Storage, Distribution and Transmission
UFC 3-240-01	Wastewater collection
UFC 3-321-064	Concrete Floor Slabs on Grade subjected to Heavy Loads
UFC 3-301-01	Structural Engineering
UFC 3-320-06A	Concrete Floor Slab on Grade Subjected to Heavy Loads
UFC 3-401-01	Mechanical Engineering
UFC 3-410-01	Heating, Ventilating, and Air Conditioning Systems
UFC 3-410-02	Direct Digital Control For HVAC And Other Building Control Systems

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UFC 3-420-01	Plumbing Systems
UFC 3-420-02FA	Compressed Air
UFC 3-430-02FA	Central Steam Boiler Plants
UFC 3-450-01	Noise and Vibration Control
UFC 3-501-01	Electrical Engineering
UFC 3-520-01	Interior Electrical Systems
UFC 3-530-01	Interior and Exterior Lighting Systems and Controls
UFC 3-575-01	Lightning and Static Electricity Protection Systems
UFC 3-580-01	Telecommunications Interior Infrastructure Planning and Design
UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings
UFC 4-010-06	Cybersecurity of Facility-Related Control Systems
UFC 4-021-01	Design and O&M: Mass Notification Systems
UFC 4-021-02	Electronic Security Systems
UFC 4-023-03	Design of Buildings to Resist Progressive Collapse  (a) Always utilize latest edition of this document, regardless of references in this RFP or in other publications.  (b) Note the option to use "tie-force" method or "alternate

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	path" design for Occupancy Category II.
UFC 4-510-01	Design: Military Medical Facilities
Department of Defense (DOD)	
	DOD Strategic Sustainability Performance Plan
6055.18-M	Safety Standards for Microbiological and Biomedical Laboratories
AR 190-17	Biological Select Agents and Toxins Security Program
5210.88	Minimum Security Standards for Safeguarding Biological Select Agents and Toxins
5200.1-R	Information Security Program
8500.01	Cybersecurity
8510.01	Risk Management Framework (RMF) for DoD Information Technology (IT)

-End of Section-

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CHAPTER 5  
Functional Requirements

## 5.0 FUNCTIONAL REQUIREMENTS

Room Data Sheets present minimum room requirements are provided in Appendix B. Room Data Sheets provided for rooms and spaces as part of a standard design, and may not be a complete list of all spaces, nor are identified requirements considered a total/maximum criterion of functional and operability need for each room and not intended to be a complete list of requirements. Variations may include quantity and types of equipment, types of spaces, number of personnel in rooms, etc.

### 5.1 PROJECT DESIGN REQUIREMENTS

#### 5.1.1 ARCHITECTURAL DESIGN

Programming data, functional analysis and site planning issues indicate the preferred solution for the EDS system to be provided within Building 8100 to support the BSL3 and BSL4 effluent system for only building 8100. It is recommended that the consolidation of the following program and functional requirements be the suitable alternative from an economic as well as from an operational perspective. A complete architectural design shall be provided for the facility, as described for this particular project. Refer to other sections of this RFP for additional requirements. If conflicts occur between this Chapter 3 and Chapter 5 of this RFP Section the Chapter 3 reference shall govern.

#### 5.1.2 DESIGN SERVICES

Provide complete Architectural design services in accordance with the International Building Code and all other applicable building codes, regulations, laws, and standards as listed herein and in Chapter 4 of this RFP Section. Within these guidelines, Architectural services shall fully delineate and coordinate all design and engineering aspects necessary to provide a fully functional EDS system with Building 8100. Upon completion of work the contractor to submit a record set of the Operations and Maintenance (O&M), as defined in specification section 01 33 00. Provider shall be responsible for Architectural design, EDS Equipment design and all supporting utilities and MEP equipment to support the new EDS system. Designer shall delineate spatial layouts identifying finishes, furniture, fixtures, EDS equipment and all MEP equipment to support the new EDS system, as required for each using organization. Design and construction shall provide Structural Interior Design (SID) for building finishes as well as Comprehensive Interior Design (CID) as defined in this RFP document. Design of building elevations, site plan, and overall EDS and MEP system design image shall be in accordance with this RFP document. Refer to other sections of this RFP for additional requirements.

#### 5.1.3 BUILDING PLANS

Plans indicating the spatial relationships of internal spaces of the EDS system and supporting MEP spaces and equipment are included in this RFP. The spaces were generated from information gathered from the using organizations through site visits and a series of meetings. The organizations' missions are ever evolving, and all information must be verified prior to preparation of the Design-Build Documents. The designer of record has the freedom to provide relocation of EDS, MEP equipment or indicated utilities where the benefit to reorganize can be demonstrated. Drawings and diagrams provided in Appendix F of this RFP document are provided for design intent. The DOR (AE-2) can deviate from the design intent, with the approval of the government agency responsible for the project. Locations of the partitions shown on this plan shall not be considered accurate or complete.

### 5.2 BUILDING PROGRAMMING DESIGN

#### 5.2.1 PROGRAMMED GROSS AREA OF BUILDINGS

Gross Area of Primary Facilities may not exceed Programmed Gross Areas. Calculate Gross Building Areas per UFC 3-101-01.



## 5.2.2 CODE, CRITERIA & LIFE SAFETY REQUIREMENTS

Design and construct project scope and requirements as outlined, or referenced in this RFP, and/or criteria listed in Chapter 4.

## 5.2.3 ADJACENCY AND FUNCTIONAL REQUIREMENTS

Building layout shall consolidate and support functional operational performance of spaces/rooms for efficient workflow and functional adjacencies as indicated by Room Data Sheets. Changes to specified functional areas and adjacencies identified shall be avoided, however where deviations are unavoidable, Contractor shall clearly identify differences within proposals.

## 5.3 REQUIRED ASSEMBLIES

### 5.3.1 DOORS AND FRAMES

Provide doors and frames per Chapter 6. For all doors achieve Maximum force for pushing or pulling open a door or gate shall be no more than 5 pounds.

Interior doors and frames: Provide hollow metal steel doors and frames. Coordinate hardware, Fire ratings, Acoustical STC ratings, as indicated and/or required. Doors and hardware shall comply with ABA Standards. Maximum force for pushing or pulling open a door or gate shall be no more than 5 pounds. Provide doors and frames no less than Extra Heavy Duty Doors per SDI/DOOR A250.8, Level 3, physical performance Level A.

Architectural Barriers Act (ABA): Doors and hardware shall comply with ABA Standards. Maximum force for pushing or pulling open a door or gate shall be no more than 5 pounds. Achieve low force required for opening and closing doors with overhead closers including power assist, and/or, provide blue button handicapped operators with overhead power assist through the entire opening cycle.

### 5.3.2 Windows and frames

Provide Windows and frames per Chapter 6.

### 5.3.3 Assembly for Exterior Enclosures

Provide exterior materials, finishes, and colors complying with Fort Detrick Installation Planning Standards.

### 5.3.4 Assemblies for Interior : Provide Interior materials, finishes, and requirements as follows:

1. Interior Finishes: For room finished refer to Room Data Sheets.
2. Interior Walls: Refer to drawings sheet A-720 for Partition Types. Extend partitions scheduled as fire rated, STC rated, and security walls full height. Provide partitions with minimum STC rating indicated unless Room Data Sheets identify a greater value.
3. New full height, sealed walls to be provided around the containment areas. Walls to be fully sealed to restrict passage of air through the containment walls. Walls to be watertight, around the containment areas to prevent the passage of contaminated liquid from the containment area. Containment walls to be constructed with reinforced CMU to approximately 9'-4" above finished floor. Continuation of the walls, to the underside of the floor construction above, to be constructed with double layer GWB both sides wall, on a metal stud partition system. Gwb wall above the CMU construction to be properly braced with diagonal stud bracing to the

structural above, to provide proper lateral bracing for the wall. The GWB wall construction above shall maintain the wall design to restrict the passage of air while allowing an easier method to provide wall penetrations for new and existing utilities at the upper area. All wall penetrations to be fully sealed to maintain air restriction passage through the wall. All wall penetrations to be fully sealed to maintain air restriction passage through the wall. The smoke penetration testing shall be tested at a differential pressure of 0.10" w.c.; temporary augmented air pressurization devices/fans may be required to meet the 0.1" w.c. testing condition. All penetrations in new containment walls to be leak tested with a smoke pencil test that does not allow smoke to mitigate into the penetration. Repair of all wall penetration leakage which are found to be resealed with new sealant to meet the requirements of a new smoke pencil test to be conducted upon completion of the repair of the penetration seal system

4. New EDS Containment Slab on Grade: Provide spill containment system for all EDS storage tanks, and EDS Filter as indicated on S-101 and A-105 to prevent spilled effluent from leaving the EDS controlled area and Building 8100 property. Where concrete slab on grade serves as EDS containment pit, form concrete slab on grade with integrated curbs, dyke, ramps, slopes, and sumps without drains. EDS containment area within curbed area to be designed to maintain effluent volume of one full EDS tank. Collection of spills containment area by authorized personnel and return back into the EDS system for processing. Construct new concrete slab on grade with a required 6 ml vapor barrier membrane.

## 5.4 PROJECT DESIGN

### 5.4.1 ROOM DATA SHEETS

Room data sheets in this RFP provide the using organizations' requirements for each work group to be accommodated in Building 8100. The organizations' missions are evolving, and all information must be verified prior to preparation of the Design-Build Documents.

### 5.4.2 BETTERMENTS

Materials and finishes noted in this RFP shall be considered to be minimum requirements. Improved finishes and other proposed "betterments" are allowed and encouraged, and shall be documented in accordance with betterments provisions in the Project Solicitation. A "betterment" is defined as any component or system which exceeds the minimum requirements for quality, and/or aesthetics, stated in the RFP.

## 5.5 EFFLUENT DECONTAMINATION SYSTEM (EDS)

### 5.5.1 EDS OVERVIEW

This section establishes and describes the relevant design scope and criteria for the overall Effluent Decontamination System (EDS) incorporation associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. Biowaste generated from BSL3 and BSL4 labs areas and plumbing fixtures is conveyed by gravity to the Biowaste collection tanks. The boundary of the EDS vendor scope starts at the interface between the Biowaste drainage piping and the isolation valves at the Biowaste storage tanks. The Biowaste is processed through multiple EDS vendor provided skids and the Decontaminated waste is discharged to the building sanitary drainage system. The discharge from the EDS skid is the termination point of the EDS vendors' scope. In addition to the interconnecting piping between the skids and the waste decontamination equipment, the EDS vendor shall also provide support equipment in order that the system operates with a single point of responsibility. Support equipment includes but is not limited to a Clean-In-Place and pH neutralization skid which addresses the cleaning requirements of the

system and a dedicated heat transfer system which shall provide the economizers for the EDS system.

All interconnecting piping and wiring between skids, vessels, and other components, are part of the EDS manufacturer's scope. All elements of the EDS system, including the Continuous Processing Units shall be developed in a modular approach, meaning, that the redundancy, control, and operation shall be segmented to enable:

1. Future partial replacement by the original manufacturer or an equivalent provider,
2. Future expansion of capacities,
3. Clarity of on-line vs standby and redundant units,
4. Segmentation to facilitate maintenance & operational trouble-shooting

The EDS is comprised of multiple process steps summarized by the listing below (in order of flow path). There are three (3) primary process steps, and several required minor process steps; the primary steps are noted with an '['\*']' in the listing below. Note that the final arrangement may negate select elements, or add components largely as a result of elevation and variability of inflow rates which occur as a result of normal variations throughout the day. The listing below is not intended to address full detailing such as line arrangements, parallel components or redundancies, nor ancillary processes such as control and monitoring, pH correction or thermal or chemical component decontamination.

1. Storage (Queue) Vessels [ '\* ]
2. Recirculation/Solids Reduction Pumps
3. Solids Removal / Filtration [ '\* ]
4. Transfer Pumping skid
5. EDS Continuous Process Units [ '\* ]
6. Heat transfer loop and Expansion tank
7. Clean-In-Place descaling / pH neutralization skids

#### 5.5.2 STORAGE (QUEUEING) VESSELS

Due to both the high level of Biowaste inflow variability during the day, and the reliability and efficiency interests of running a stable EDS process phase, queuing and EDS feed pumping provide flow stability and the required pressure to the EDS continuous process units.

For full service life, and reliability, the storage vessels are intended to perform without significant solids accumulation. Continuous or intermittent mixing shall be provided in the Queuing Storage vessels by a recirculation pump (see section below) to suspend any fine particles which otherwise may settle while queued.

Queue Storage Vessel vents shall require a double HEPA in series filtration arrangement, as well as parallel redundant HEPA filter modules to enable vent HEPA decontamination and service; this arrangement is similar to other vent HEPA filtration modules used in the USAMRID Replacement BSL-4 Biowaste vents. Refer to the Plumbing Section for further information.

Queue Storage Vessels normally operate at atmospheric pressure with occasional steam sterilization. Therefore, the vessels shall be fabricated, tested and certified to receive ASME 'U stamped' ('unfired pressure vessel') construction and inspection standards. Due to space constraints, these vessels shall be field fabricated to fit into Room 1SA202 in the existing level 1 of Building 8100. An ASME code certifier shall be on-site for inspection and vessel stamping of all field assembled vessels.

Redundant Queue Storage shall be required to enable routine service and inspection of one module of Queue Storage Vessels. Queue Storage Vessels shall be provided with instrumentation, inspection/service manways, steam connections, compressed air connections and non-potable water connections to support thermal decontamination in place. Queue Storage Vessels shall be accessed only through USAMRIID Biosafety Officer Supervision, and protocols to address multiple hazards including those commonly associated with 'controlled entry' spaces.

It is desired that the Queue Storage Vessels be capable of storing Biowaste during the annual August Central Utility Plant ('CUP') campus wide steam shut-down which lasts 2.6 days, starting on a Friday, and resuming on a Monday. The physical space only allows approximately 1.4 days of storage at peak daily demands with safety factor, so the operations shall be required to be scaled back during this shutdown. The owner accepts that the operation scale back shall be required during the shut-down. The specific date of this shut-down is coordinated with the USAG Fort Detrick.

Queue Storage Vessels shall require liquid leak spill retention for between 1 and 2 days, and scaled in excess of 120% of one storage module plus a 50% safety factor to support miscellaneous simultaneous spills, and a short duration sprinkler release (20 min. over 1,500 SF). Note containment shall be isolated per tank to provide the flexibility for continual usage of other tanks.

#### 5.5.3 RECIRCULATION/SOLID REDUCTION PUMP (SKIDDED EQUIPMENT)

The Biowaste flow stream is known to contain small quantities of solids. The source of the solids is dominantly from the Vivarium and animal holding rooms which have strainer baskets at the room drains; however, it would be expected that occasionally due to human error or failure of a drain strainer basket, some solids can be washed down through the Biowaste system. Similarly, small particles of bedding, small fragments of plastic Non-Human Primate (NHP) enrichment toys, or similar may find their way into the Biowaste streams and the system must be configured to address these materials.

It is expected that large solids shall be introduced into the EDS. A duplex set of Chopper pumps shall be provided at the discharge end of the tanks to reduce the size of the solids and minimize potential clogging. These pumps shall also assist in the circulation of waste from the discharge end of the tank to the back end of the tank. This recirculation jet flow/mixing action in conjunction with the sloped tank bottom shall promote flow of the solids to the discharge side of the tank.

#### 5.5.4 SOLIDS REMOVAL / FILTRATION (THREE (3) INDIVIDUAL SKIDS)

Any Biowaste EDS process shall remove as much of the solids materials as possible before reaching a threshold that would effectively create unnecessary labor for those operating and maintaining the EDS. The solids removal / filtration is upstream of the EDS tube skid where the thermal decontamination occurs. The removal of solids is critical to the performance of the tube skid and the decontamination process.

The solids removal / filtration phase shall include multiple parallel filtration units to enable rotation of filtration units to enable a given unit(s) to be 'taken off line' or isolated, and subsequently thermally decontaminated with steam while isolated. Two fully redundant filtration units shall be provided to ensure waste processing can continue even if one unit is off-line for an extended period for repair.

After thermal decontamination of the filtration unit, and cooling for handling, then solids can be removed safely and bagged for disposal, and any service can be done on the emptied filter section. This waste is

considered decontaminated and be removed from the facility.

The filtration phase of the EDS process shall be multiple step to optimize the performance of the solids removal / filtration to the required 500 micron (0.02 inch) sieve. Multiple step filtration enables high levels of performance or removal efficiency. Although the EDS process equipment would not be at high risk of clogging due to solids materials that can get through primary or 'rough' filtration, the temperatures required in the EDS would create performance degradation risks over time if significant amounts of plastics were able to pass the filtration phase.

#### 5.5.5 EDS CONTINUOUS PROCESSING UNITS (THREE (3) INDIVIDUAL SKIDS)

The EDS for this project which meets the performance criteria defined by the users is a thermal continuous processing system. The EDS consists of the following components.

1. Quadplex Pumps skid with upstream strainers
2. Pre Heating and Post Cooling Tube I and Tube economizers
3. Plant Steam Tube and Tube Exchanger
4. Retention Tube and Tube Heat Exchanger
5. Heat transfer loop including pump and Expansion tank.

The Continuous processing system operational description is follows. The system starts slowly recirculating waste to the Queue tank until the required temperature of 140°C is met. Once operating temperature is achieved, biowaste from EDS is discharged to the building drainage system. Note that the DB Contractor shall develop, and gain approval of a fully detailed SOP for effective sterilization of the effluent, and all EDS equipment and components to support safe and orderly operations, maintenance, testing and when needed replacement, all parts of the system and the system components which has been aligned with final decisions on arrangement, sizing, control, redundancies, service points and similar defining characteristics established during the DB design process.

The biological waste is pumped through an economizer heat exchanger to pre-heat the incoming waste stream using the dedicated heat transfer loop. The dedicated heat transfer loop provides a barrier separation from contaminated waste and is a higher pressure than the biowaste to ensure if there is a failure the barrier fluid shall leak into the process.

Following the economizer heat exchanger, the pre-heated biowaste enters the steam heat exchanger to heat the waste up to 140°C before entering the retention coil. The steam supply to the heat exchanger is modulated by an industrial grade PID control loop with inputs from the outlet temperature of the waste steam. Plant steam is also fed to the retention coil for temperature maintenance. The retention coil is designed to ensure that a 2 minute residence time for the flow rate has been achieved at the inactivation temperature of 140°C.

The waste on the outlet of the retention tube is cooled by the dedicated economizer heat transfer loop. The waste shall be cooled to a temperature less than 60 C per the plumbing code. A sparging water connection shall be provided in order to cool waste below the 60 C limit in case the economizer loop were to fail. A flow control valve is used to control the discharge flow from the pump, in order to maintain the constant flow rate required for the appropriate residence time in the retention coil.

Temperature on the outlet stream from the retention coil is used to determine if inactivation time and temperature has been achieved. If the measured temperature is below the required inactivation temperature, the recirculation port of the 3-way valve is opened and the biowaste stream is recirculated to

the storage tank. The discharge port of the 3-way valve to the building drainage system shall be closed when the waste is recirculated to the Queue tank.

The recirculation continues until the outlet stream from the retention coil reaches the required inactivation temperature. Upon achieving the inactivation temperature at the outlet of the retention coil, the recirculation port of the 3-way valve is closed and the discharge port of the 3-way valve is opened and inactivated biowaste is routed to the building drainage system. Sequencing shall be such that all piping exposed to biowaste shall be decontaminated prior to discharging deactivated waste to the building drainage system.

#### 5.5.6 TEMPERATURE AND TIME

The Chief BioSafety Officer for USAMRIID, has cited a preliminary performance criteria or User Requirement Specification ('URS') for the Building 8100 Biowaste EDS as 140°C (284 deg. F.) for a minimum hold of 2 minutes. The 2-minute deactivation time at temperature provides a significant safety factor to achieve a high surety of decontamination effectiveness on *Geobacillus Stearothermophilus*, which is the most heat resistant spores known, and is typically used as a benchmark pathogen for stringent threshold requirements of thermal deactivation.

The guidance from The Chief BioSafety Officer for USAMRIID is consistent with other 'time and temperature' references cited by EDS manufacturers and numerous scientific publications. At 140°C, the deactivation time required is 12 seconds (0.2 minutes), and at 130°C the time required is 116 seconds (approximately 2 minutes). The temperature and time relationship stated is based on the lethality curve/calculation for *Geobacillus Stearothermophilus* at 121°C for 15.4 minutes.

#### 5.6 ANTITERRORISM FORCE PROTECTION (AT/FP)

Project Design and Construction shall achieve compliance with latest version of UFC 4-010-01, "DoD Minimum Antiterrorism Standards for Buildings". Therefore, in developing proposals each Offeror shall demonstrate compliance with UFC 4-010-01. Proposed designs shall delineate whether or not minimum standoff distances for conventional construction is achieved or exceeded. Where proposed designs achieve minimum standoff distances, use of conventional construction shall provide no less than minimum DoD standards identified in UFC 4-010-01. Where proposed designs do not achieve minimum standoff distances additional hardening and progressive collapse provisions shall add to minimum construction requirements, shall be subject to Government approval and provided at no additional cost to the Government.

#### 5.7 AMERICANS WITH DISABILITIES ACT (ADA)

EDS equipment areas, mechanical areas, are exempt from meeting ADA requirements due to the nature of work performed in this area. The design shall make the best effort to provide and meet ADA requirements where possible without creating hardships to the EDS users and access to equipment. Design and space layout for all areas shall be developed with furniture placements. The overall project designs shall achieve full compliance with the Americans with Disabilities Act (ADA) as required by federal law. Compliance shall be in accordance with Americans with Disabilities Act Accessibility Guidelines (ADAAG), and/or, Uniform Federal Accessibility Standards (UFAS) whichever is most stringent. ADAAG requirements providing equal or greater accessibility than those of UFAS must also be met in facilities subject to UFAS.

#### 5.8 ADJACENCY AND FUNCTIONAL REQUIREMENTS

Building spatial layout and equipment layouts shall consolidate and functionally support requirements identified for spatial, and functional adjacencies as indicated in Chapter 6 – Section C10, Appendix G and in the Room Data Sheets in this RFP. Changes to specified functional areas, equipment layout and configuration as identified shall be avoided, however where deviations are unavoidable the Contractor shall clearly identify any differences within designs. Where gross floor area is not specified, spaces shall be sized

to accommodate purpose in accordance with code requirements, equipment size, equipment clearance limitations and other requirements of this RFP.

#### 5.8.1 LAYOUT OF PROPOSED FACILITIES

Design and layout of the proposed facilities shall accommodate programmed areas identified in this RFP document. Design shall delineate placement of EDS and MEP equipment, as listed in this RFP document. Functional spaces shall be sized, configured, and arranged with the intent of achieving the most functional layout while maintaining minimal Equipment clearance and circulation area. Design shall coordinate identified adjacencies and functional equipment placement within each area. Mechanical, electrical, and plumbing areas shall take into account necessary layout and distribution requirements including, but not limited to, location, maintenance, and exchange of equipment and stacking to achieve efficiency. Design shall take into account the removal and replacement of all equipment in the future to allow for replacement and/or repairs. The Contractor is encouraged to present innovative and cost-effective alternatives with a goal of maintaining initial lifecycle efficiencies.

#### 5.8.2 FLOOR PLANS

The layout of the spaces shall be designed for the needs of the using group that shall occupy the new facilities. Layouts shall be the result of interviews and meetings between the using organizations, USACE and the Contractor to verify, document, and incorporate the using organization's programming requirements. Documentation of this process and its results shall be part of the Design Narrative which shall be included in the design submissions for the project. Design Build contractor is not allowed to revise the final approved RFP DB design.

#### 5.8.3 EQUIPMENT PLANNING

The building designs for this project shall include the EDS Equipment layout, MEP equipment layout, plus the functional areas and adjacencies as outlined in this RFP and as established by the Contractor with the Using Agency. The actual amount of space allocated to each individual piece of equipment shall be determined by the Contractor, based on equipment manufacturer's requirements and recommendations. Coordination of EDS equipment with associated MEP equipment and utilities shall be provided by the contractor and his subcontractor and equipment vendors to provide a fully functional total system. All rooms and spaces shall be sized, configured, and arranged for the specific equipment to be house in the room. Spaces are to provide sufficient equipment clearance and circulation as required by code, equipment access and equipment maintenance. All emergency egress requirements, for all spaces and equipment, to be met. Mechanical, plumbing and electrical spaces shall take into account the placement, replacement, and maintenance of equipment. The Contractor may propose modifications to room sizes or other elements as necessary to accommodate required EDS equipment and building systems and is encouraged to present innovative and cost-effective alternatives to the criteria listed. However, major changes to specified functional areas, room sizes, and adjacencies shall be avoided. DB contractor shall coordinate all proposed changes due to coordination with equipment vendors, with the original design A/E team and USACE, to assure the design meets all requirements stated in the Final DB RFP and all building user requirements. Any spaces for which net area requirements are not specified shall be sized to accommodate the required function in accordance with code requirements, gross area limitations, operability, and other requirements of this RFP (for example, area requirements for corridors, stairs, and mechanical rooms shall typically be left to the discretion of the Offeror).

#### 5.9 CODE REQUIREMENTS

The new SSP facility shall be designed, maintained and constructed in accordance with United Facilities Criteria (UFC) 1-200-01, and UFC 3-600-01. Where there is a case of conflicting requirements the most stringent requirement shall apply. UFC 3-600-01 makes the following references: a) applicable portions of the International Building Code (IBC) for the following: type of construction, fire resistance requirements,

allowable floor area, building height limitations, and building separation distance requirements; and b) building construction related to egress and safety to life shall comply with NFPA 101. Type of occupancy shall be in accordance with IBC and NFPA. The original USAMRIID Building 8100 code requirements to apply under the IECC 2018 Code requirements.

AHJ – Authority Having Jurisdiction: During design and the subsequent design-build process, variances to the Fort Detrick design criteria may be required. All variances identified during design and construction shall be reviewed with the Authority Having Jurisdiction (AHJ) and Government representatives for acceptance. For code interpretations or requests for proposed code or military criteria deviation request during construction the AHJ to be HQ-USACE IAW following UFC 3-600-01. After construction the AHJ building code authority is turned over to Fort Detrick AHJ. AHJ actions shall be coordinated through USACE, which shall involve both parties. All permits during construction shall be established by the HQ-USACE IAW that has full authority on site. It shall be the responsibility of the Design Build contractor to confirm all permit requirement with HQ-USACE IAW.

- 5.9.1 OCCUPANCY, TYPE OF CONSTRUCTION, AND LIFE SAFETY: REFER TO LIFE SAFETY PLAN G-101.
- 5.9.2 IBC Chapter 3 – Use and Occupancy Classification is implemented by UFC 1-200-01 Section 2-3 in accordance with NFPA 101 through reference from UFC 3-600-01; NFPA 101 takes precedence in conflicts. IBC Chapter 3 is required to utilize IBC Height, Area, Separation and Construction Classification criteria. NFPA 30 and 45 supersede IBC Section 307 High-hazard Group H since NFPA 101 takes precedence in conflicts. The AHJ, on the original USAMRIID Replacement project has concurred that the intent of UFC-3-600-01 is to utilize NFPA 45 in lieu of IBC Sections 307 and 414.
- 5.9.3 The proposed EDS space and associated MEP area was originally classified as an Unoccupied Interstitial Pipe Access area with a Use Group F-1 (Factory Moderate-Hazard Use Group).
- 5.9.4 USAMRIID Replacement was determined to be Type 1 Construction. Fire rated partitions require compliance with NFPA 101 for fire resistance ratings of non-bearing partitions in Type 1 construction. This UFC 03-600-01 reference to Chapter 8 of NFPA 101 conflicts with the UFC 1-200-01 use of Chapter 7 of the IBC. Types of Construction requires compliance with IBC for permitted types of construction. Construction Type 1B is required by the main uses due to the height and area of the building, in conjunction with the appropriate incidental and accessory uses. IBC Chapter 6 – Types of Construction is implemented by UFC 1-200-01 Section 2-6 Chapter 6 and UFC 3-600-01 Chapter 6. This section identifies the assignment of the classification of the requirements for the fire ratings of building and structural elements within. The type of construction selected is Type 1B. The fire ratings of structural and building components for Construction Type 1B per IBC Table 601.
- 5.9.5 Current USAMRIID Replacement Building Construction Type IB per the 2006 International Building Code Chapter 5, General Building Limitations Table 4503
1. New EDS renovation alteration area shall maintain the current IB construction type
  2. Allowable Area – Unlimited
  3. Allowable Height – 160 ft. + 20 Ft Sprinkler Add = 180 ft.
- 5.9.6 Fire Resistance Rating of Elements
1. Per 2006 IBC Chapter 6 Table 601 – Fire Resistance Rating requirements for Building Elements



## Repair Steam Sterilization Plant (SSP)

DB RFP Requirements

Ft. Detrick, MD

## Chapter 5 Functional Requirements

- |    |                                    |         |
|----|------------------------------------|---------|
| a. | Structural Frame                   | 2 Hours |
| b. | Exterior Bearing Walls             | 2 Hours |
| c. | Interior Bearing Walls             | 2 Hours |
| d. | Non-Bearing Exterior Walls         | 0 Hours |
| e. | Non-Bearing Interior Walls         | 0 Hours |
| f. | Floor Construction including beams | 2 Hours |

- 5.9.7 Seismic requirements - Current building structure, structural elements and components are designed to meet Item 2 requirements below. No upgrade to the current structure and components that are remaining, is required.

New seismic restraint shall be required to be provided for all non-structural architectural (i.e. fire protection systems, etc.) or containing hazards (i.e. flammable or toxic hazards) materials. All new EDS process/filtration equipment, holding tanks, all associated utilities and piping conveying biological hazardous material are considered a critical system and shall be required to meet are required to meet the requirements of Item 1, listed below;

1. Current requirements requested under special criteria and instructions per the RFP.

- a. Risk Category III
- b. Design Category C
- c. Spectral Response Acceleration 0.04g
- d. Component Importance Factor 1.5

2. Original USAMRIID Replacement project requirements as dated 2006.

- a. Risk Category III
- b. Design Category B
- c. Spectral Response Acceleration 0.051g
- d. Component Importance Factor 1.5

- 5.9.8 Building alterations are identified under UFC 1-200 -01 reference as modified by UFC 3-600-01. Special reference to UFC-3-600-01 Chapter 34 requirements are to be met, under modification of a building.

1. The current Use Group in the Unoccupied Interstitial Pipe Inspection Area at Level 1 shall be converted to house the new EDS equipment and required equipment support spaces. The existing Use Group F-1 (Factory Moderate-Hazard Use Group) shall be maintained and any work within the existing area shall meet the previous code requirements under the IBC 2006 and NFPA 2003.. Note no Change of Use is planned and the existing F-1 Use group to remain in the alteration area. Per current NFPA building rehabilitation classification the following shall be met:

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- a. Per NFPA 101 Section 43.2.2.1.2 Renovation. The replacement in kind, strengthening, or upgrading of building elements, materials, equipment, or fixtures, that does not result in a reconfiguration of the building spaces within.
- b. Per NFPA 101 Section 43.2.2.1.3 Modification. The reconfiguration of any space; the addition, relocation, or elimination of any door or window; the addition or elimination of load-bearing elements; the extension of any system, or the installation of any additional equipment. The renovated area does not meet the requirements for extensive modification per section 43.5.2.
- i. Per NFPA 101 Section 43.5.2.3. The renovated area is under 50% of the existing floor area and does not need to be classified under extensive modification.

#### 5.9.9 BMBL –Biosafety in Microbiological and Biomedical Laboratories

The new construction area within Building 8100 facility shall be designed, maintained and constructed in accordance with the BMBL (6<sup>th</sup> Edition). The BMBL is a guidance document and not a code or regulations that guides the contractor in the proper methods to meet the BMBL guidelines. The original USAMRIID Building 8100 code requirements to apply under the BMBL edition, during the time of construction. The existing construction does not need to be upgraded to the current BMBL edition. New equipment installation and construction methods shall take the guidance of the BMBL (6<sup>th</sup> Edition) . As the BMBL is considered a live document, the project shall evaluate the current BMBL requirements and when differences are identified that impact the concept design, these differences shall be reviewed with Government for direction.

#### 5.10 DESIGN FREEDOM

The conceptual level (approximately 35%) drawings attached to the specifications provide floor plan and effluent decontamination system (EDS) system layout, as well as layout of supporting systems and utilities, to convey the design intent with respect to redundancy, operational, and maintenance requirements and are to be used as the basis of design for design progression to 100% design. Not all necessary/required components are shown. The contractor's design engineers and architects of record are responsible for providing a complete coordinated design that meets all of the requirements of the contract. Revision or modification of indicated building plans, equipment layout and forms shall only be allowed with government approval and users' operability requirements are accommodated as per the contract.

#### 5.11 CONSTRUCTION WORK PROTECTION

During construction the contractor to provide material and labor to provide dust protection and material to protect all equipment and utilities that are not scheduled to be demolished. During construction protection material and dust protection measures to be maintained. All equipment, building elements, and utilities not scheduled to be removed are to be protected during demolition. Any damaged equipment, utilities or building elements to be or replaced to the original condition.

#### 5.12 CONSTRUCTION PHASING AND STAGING

DB Design contractor to provide a construction phasing plan and schedule into the bid documents. The final selected Design Build contractor to develop, in coordination with USACE, a detailed overall phasing plan addressing maximum permissible durations of interruption of Building 8100 engineering services, outside utilities, roads or pathways. Define temporary measures to continue services with minimal interruptions during normal working hours. Additional duration hours and cost to for additional hours, manpower, equipment and material to be built in the bid schedule and final construction cost.

The DB Design contractor to define the Final Design Build contractor staging areas in the interior and exterior of the building that does not interfere with the daily operation of Building 8100. The proposed staging area to be coordinated with USACE as not to deter the building and site security requirements of the original Building 8100. The staging area is only to be used for Contractor required materials and equipment to be used for this specific project. The contractor is responsible for all stored material and to provide security measures to secure and protect the staging area and equipment. The contractor to take full responsibility of all contractors stored material and equipment on site.

### 5.13 ACCESSIBILITY AND OPERABILITY REQUIREMENTS

All components of the EDS and supporting plumbing, HVAC, seismic, Electrical, Fire Protection, controls, and other systems and equipment which require observation, inspection, maintenance, recertification, or eventual removal and replacement shall be safely accessible for such purposes, being installed in such configuration and clearances from other equipment as to meet code standards for dedicated space, safe operation, cooling, thermal insulation, and protection from water damage.

Where practicable, access shall be provided without the need for portable ladders; where not practical access may be provided by fixed ladders or portable ladders not exceeding 8' in height, powered lifts, or fixed catwalks, working platforms, etc. All access shall be accommodated by dedicated and marked lanes, unobstructed by primary, distribution, or supporting/bracing equipment and components, suitable for the transport of ladders and lifting equipment, not requiring crawling or bending under, or stepping over, obstacles. Where portable ladders are required for access, it shall be possible for staff to execute the required task while maintaining three points of contact with the ladder (typically feet and torso), with the center of the torso (belt buckle) remaining between the two rails, and otherwise in accordance EM 385-1-1.

For all equipment, there shall be a clear access pathway with adequate clearance from other equipment to the exterior of the building for to permit future removal and replacement without the necessity of relocating other equipment which would result in the interruption or reduction of capacity of the EDS system.

Access to accessory or other equipment located atop or above primary equipment such as storage tanks, air handling equipment, electrical equipment, etc., shall not require personnel to climb onto or work directly upon the primary equipment; where necessary provide semi-permanent (removable for future relocation or replacement) ladders, catwalks, and working platforms.

All aspects of the project accessibility requirements are to be modeled in BIM, in accordance with UFGS 01 33 16.00 10 and referenced standards located at the CAD/BIM technology center website, in particular the USACE Minimum Modeling Matrix (M3). Within this document, the term "Level of Development (LOD)" is used to define the detail that the DORs need to provide in their model. Final modeling for shop drawing/installation shall include all primary equipment, and distribution equipment greater than 1/2" in diameter, to include all support and bracing elements.

To ensure the continuity of operation of the EDS and supporting equipment, the DBC shall perform a risk analysis to identify any of those single components of the EDS or supporting engineering systems which, in case of failure, will interrupt or interfere with the operation of the EDS; one example being isolation valves, requiring three-piece ball valves or (where permitted by the RFP) butterfly valves enabling the removal and replacement of the valve assembly while minimizing impact to the EDS. Where such single point of failure devices is identified, the design shall provide redundancy or similar means of eliminating or minimizing the impact of replacement.

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CHAPTER 6  
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**Repair Steam Sterilization Plant (SSP)**

DB RFP Requirements

Ft. Detrick, MD

Chapter 6

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## CHAPTER 6

### A10 Structural and Existing Foundation Modifications

## A10 STRUCTURAL ENGINEERING

## SYSTEM DESCRIPTION

Volume 1, Section 6, Structural, establishes and describes the relevant design scope and criteria for the structural modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. The structural systems to be analyzed, designed, and documented include localized modifications to foundations and grade supported floor slabs. Additionally, structural design associated with minor modifications to localized portions of architectural building facade shall be included.

The structural modifications to the existing Building 8100 Structure for the addition of the new SSP shall consist of the following:

## A10 1.1 TANK SUPPORT

The proposed mechanical equipment layout for the SSP currently includes the addition of (4) new 25,000 gallon storage tanks to be placed on the existing first floor (elevation 366'-0") between Grid Lines WG & WN and W7 & W11. Two options for support of the tanks were investigated. Option 1 utilized 30"x30" grade beams (reinforced with 4-#8 top and 8-#8 bottom) spanning between and anchored into existing column drilled piers to support the tank mat slab. Option 2 used (8) 7" diameter Micropiles with a 5'-0" rock socket x 35'-0" long (22'-6" of rock + 12'-6" of soil) reinforced with 1-#8 vertical spaced (2 piles in the middle sections and 1 pile at each end) approximately 21 feet on center along each of the tank mat slabs. The mat slab shall consist of a 15" thick normal weight concrete reinforced with #8@12"o.c. each way top and bottom spanning over the foundations with the top of mat level with the top of existing finished floor. Upon review of the estimate for the options it was deemed that although the existing drilled piers had sufficient reserve capacity to accommodate the loading from the new grade beams, pad and tank in Option 1 it would be a more cost effective and low risk solution to utilize the new micropiles in Option 2. Therefore Option 2 is to be used as the basis of design. If an alternate pad foundation approach is believed by the contractor to result in equal or improved value, the contractor may present the design to the Government for review and approval.

## A10 1.2 CONTAINMENT

An area within the footprint of the proposed mechanical equipment layout shall be required to hold the contents and flow from a compromised storage tank. Thus the existing 4" thick concrete slab in the area between Grid Lines WD7 & WN and W7 & W11 shall be removed and a new 6" concrete slab-on-grade (with W.W.F. reinforcement for temp. & shrinkage) shall be installed at 9" below existing finished floor (elevation 365'-3"), except in the immediate areas below the equipment and tanks where thickened slabs shall be installed for their support. Immediately below, a layer of 15 mil vapor retarder shall be placed over 6" of porous fill across the entire containment area including the locations of the equipment pads and tank mats.

## A10 1.3 EQUIPMENT SUPPORT PADS

Separate from the storage tanks, mechanical equipment within the containment area shall be supported on 10" thick reinforced concrete slab-on-grade pads (top of pad elevation 365'-7"). West of the containment area typical 4" housekeeping pads (with W.W.F. reinforcement for temp. & shrinkage) shall be used over the existing slab to remain.

**A10 1.4 LOUVER OPENINGS**

On the South-West exterior along Grids WA and W14, new openings shall be required to be cut into the existing exterior precast panels to accommodate new mechanical louvers. Steel framing with anchorage around the panels spanning back to building structure shall be incorporated for support of the modified panels.

**A10 1.5 EXTERIOR ACCESS PANEL**

A new opening is currently proposed to be added along Grid WA south of W8 to allow for equipment access. Structural steel support of the existing exterior panel around the new opening shall be incorporated as well as the addition to detailed concrete work in the area of the threshold such as grouting, patching and possibly connection of steel framing to the existing foundation.

**A10 1.6 ELECTRICAL ROOM LID**

The proposed Electrical Room shall require a waterproof fire-rated ceiling assembly thus a concrete slab on deck shall be utilized spanning to and supported by the CMU partitions. The lid shall consist of a 3½" thick normal weight concrete slab on a 3"-18 gage composite metal deck (with W.W.F. reinforcement for temp. & shrinkage) spanning one-way across the short direction of the room.

**A10 2.0 DESIGN CRITERIA****A10 2.1 GEOTECHNICAL PROPERTIES**

The Steam Sterilization Plant Repair (B8100) Effluent Decontamination System (EDS) Fort Detrick-Fredrick, Maryland Final RFP Geotechnical Report Dated May 2020 by US Army Corps of Engineers Baltimore District which provides updated design information as well as the 95% geotechnical investigation and report for the existing USAMRIID Replacement Building installation completed by The U.S. Army Corps of Engineers – Baltimore District (CENAB) in May 2008 has been utilized for the basis of foundation recommendations. The items below represent design information culled from the Geotechnical Reports that shall affect the structural design of the SSP within the Building 8100 structure.

**1. Soil Conditions**

- a. The soil at the project site consists of residual soils over weathered limestone. The soil thickness is highly variable due to the elevation of the bedrock surface (pinnacled rock surface) which ranges between 5 to 23' below existing grade. The existing soil consists primarily of clays and silts that were not recommended as fill material.

**2. Bearing Capacity**

- a. Building columns were supported on drilled piers that derived their capacity from skin friction in a socket into the limestone. An allowable side shear capacity of 6.0 ksf was originally identified and later updated to 20.0ksf in the Geotechnical Report upon results of the Osterberg Cell Load Test. A modulus of subgrade reaction of 100 pci was used for the design of shallow mat foundations.
- b. An allowable column load of 80 kips plus an average downdrag load of 13 kips per 7" diameter micropile of 35' average length has been assumed for bidding purposes.



3. Settlement
  - a. Settlement of the caissons was anticipated to be less than 1/2".
4. Soil Unit Weight
  - a. A minimum soil weight of 120 pcf was to be utilized for design.
5. Groundwater
  - a. A groundwater level to elevation 357 feet has been conservatively assumed in preparation of the current submittal in based on information available within the 95% Geotechnical Report.
6. Frost Depth
  - a. A minimum frost depth of 30" in accordance with the Geotechnical Report was utilized.

#### A10 2.2 DESIGN LOADS

Design loads presented below are consistent with load data presented in the 2018 edition of the International Building Code (IBC 2018), as modified by UFC 3-301-01: Structural Engineering (dated 4 February 2022) and as established by the USAMRIID A/E. The Occupancy Category in Table 1 of UFC 3-310-01 is taken as Category III.

1. Dead Loads – Superimposed

3½" Normal Weight Concrete Slab on 3" Composite Metal Deck	75 psf
Ceiling	5 psf
MEP Systems	10 psf
Framing and Fireproofing	10 psf
Exterior Walls (Precast/CMU)	100 psf of wall surface
Partitions*	included in live loads greater than 80 psf
CMU Partitions	60 psf of wall surface

\* Applies to gypsum board and stud partitions, or similar. CMU or concrete partitions shall be evaluated separately.
2. Live Loads

General Office Areas	100 psf*
Mechanical Equipment Spaces	125 psf

Electrical Room 150 psf

Electrical Room Lid 20 psf

\*100 psf is a minimum live load requirement for Fort Detrick as stated in the "Design Criteria for Microbiological Facilities at Fort Detrick – September 1992."

3. Lateral Loads

a. Seismic Criteria

Site Class: D

Occupancy (Risk) Category: III

Importance Factor ( $I_e$ ) = 1.25

$F_a$  = 1.6

$F_v$  = 2.4

$S_{ms}$  = 0.21

$S_{m1}$  = 0.102

$S_{ds}$  = 0.14

$S_{d1}$  = 0.068

$S_s$  = 0.161 (per 2006 IBC and RFP Section VII.4) 0.131 (per 2018 IBC)

$S_1$  = 0.043 (per 2018 IBC and RFP Section VII.4) 0.051 (per 2006 IBC)

Seismic Design Category: C (per RFP Section VII.4) B (per 2006 IBC and 2018 IBC)

Component Importance Factor = 1.5

[Values in bold shall be utilized for new construction]

b. Wind Criteria

Wind Speed = 119 mph

Exposure = C

4. Seismic Restraint of Non-Structural Components

Based on the current scope incorporating Seismic Design Category C, seismic restraint shall be required to be provided for all non-structural architectural components and only non-structural mechanical, electrical and plumbing (M/E/P) components related to life safety (i.e. fire protection systems, etc.) or containing hazards (i.e. flammable or toxic

hazards) materials. All new process equipment, including its components (i.e.-piping, etc.) and new supporting structure shall be considered to be life safety and/or containing hazards and as such shall be seismically restrained to meet the requirements of the 2018 edition of the International Building Code (IBC 2018) and ASCE/SEI 7-16, as modified by UFC 3-301-01: Structural Engineering (dated 4 February 2022),

#### 5. Equipment Loads

The following design dead loads for new mechanical and plumbing equipment associated with the Building 8100 SSP have been provided by CRB USA on February 14, 2020 based on their preliminary design layout.

Storage Tank	250,000 lbs. (7' diameter x 90'-0" long)
Pump/Filtration Skid	5,000 lbs. (13'-0"L x 8'-6"W x 7'-6"H)
Effluent Decontamination System (EDS)	18,000 lbs. (30'-0"L x 8'-0"W x 8'-0"H)
CIP/Neutralization System	4,000 lbs. (13'-6"L x 6'-6"W x 10'-6"H)
Heat Transfer Fluid Pump & Tank	2,500 lbs. (5'-0"L x 5'-0"W x 3'-6"H)
Quad-Plex Feed Pump	5,000 lbs. (8'-0"L x 10'-0"W)
Duplex Agitator Recirculation Pump	3,000 lbs. (6'-0"L x 6'-0"W)

#### A10 3.0 STRUCTURAL MEDIUM – MATERIALS USAGE

Poured in Place (P-I-P) concrete and structural steel are the primary structural materials of construction for the existing USAMRIID building structure. New construction associated with the Structural Scope for the Building 8100 SSP shall utilize similar materials.

#### A10 4.0 REFERENCE MATERIALS

The following information associated with the Structural Scope for the Building 8100 SSP is available in the locations noted:

##### Appendix A – Geotechnical Information

Final RFP Geotechnical Report

95% USAMRIID Geotechnical Report

##### Appendix E – 02 Structural Existing Drawings

S0.11-General Information

S1.02DP-Drilled Pier Plan-Part 2

S1.03DP-Drilled Pier Plan-Part 3

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S1.02-Foundation Plan-Part 2

S1.03-Foundation Plan-Part 3

S1.12-Floor 1 Slab on Grade Plan-Part 2

S1.12H-Floor 1 Slab on Grade Plan-Part 2

S1.13-Floor 1 Slab on Grade Plan-Part 3

S1.13H-Floor 1 Slab on Grade Plan-Part 3

S2.01-Foundation Schedules and Details

S2.37-Concrete Bearing Wall Details High Containment

S3.12-Foundations Sections and Details

S4.02-Slab on Grade Typical Details

Appendix F – 02 Structural Drawings and Diagrams

S-001 General Information

S-101 Foundation and First Floor Plan – Level 01

S-401 Typical Concrete Details

Appendix J – Structural Calculations

USAMRIID SSP Replacement RFP Structural Calculations

-End of Section-

## CHAPTER 6

### B10 Architecture Exterior Modifications

## B10 EXTERIOR ENCLOSURE

### SYSTEM DESCRIPTION

Revisions to the existing USAMRID building enclosure consists of providing two new openings in the existing exterior concrete panel wall system for new mechanical ventilation louvers and one entry opening to allow the new EDS and supporting MEP equipment to enter Room ISA202.

The two new exterior mechanical ventilation louvers openings shall be created within the existing exterior concrete wall panel system. The new openings shall be provided with new structural framing to support the existing concrete panel veneer and new wall opening. Openings to be installed at a minimum of 10'-0" above finished grade to maintain the original exterior security protocols of USAMRID

The one entry opening shall be cut into the existing exterior concrete panel system. Upon completion of construction, the removed concrete panel is to be reinstalled back into the exterior opening and sealed air tight. The concrete panel is to be reinstalled to maintain security protocols of the original design. New steel framing and support clips to be provided, within Room ISA202, to fully secure the panel from within the space. Framing and clips are to be designed to allow future removal, from inside room ISA202, to allow removal and installation of EDS or MEP equipment within the room that requires replacement. The original wall thermal insulation value is to be maintained, upon completion.

### GENERAL SYSTEMS REQUIREMENTS

#### B10 1.1 EXTERIOR WALLS

Provide a single thickness, barrier wall composed of an Exterior Closure assembly indicated below.

Provide exterior wall construction that matches the existing exterior skin system of non-structural outside face elements with integrated wall systems that include: flashing (embedded, exposed, and thru-wall), a water resistive barrier, moisture barrier/ vapor retarder (if required), air barrier, and insulation systems with interior skin system materials achieving a protective finish on interior face of exterior walls. Provide all components necessary for a shingled water resistive barrier to direct water that would penetrate the wall and direct it outside of the wall to drain away from building. Provide exterior enclosure components and barriers in accordance with UFC 3-101-01, Architecture.

New repair or renovation work to the existing exterior walls to be cut and/or patched to match the existing building material, style and color. Materials or methods of repair to match existing conditions.

Design all work to comply with UFC 3-101-01, Architecture, and UFC 3-301-01, Structural Engineering, and requirements as follows:

**Water Penetration** - No water penetration must occur at a pressure of 8 psf of fixed area when tested in accordance with ASTM E 331.

**Insulating Value** – Comply with UFC 3-101-01, Architecture, for the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standards to determine the minimum insulating value of the complete wall system. Minimum insulation value to meet ASHRAE 90.1 2013 edition, climate zone 4A for Ft Detrick area. For this project, Exterior Enclosure Systems throughout shall be no less than  $R \geq 40$ .

Out-of-plane deflection limits for framing supporting exterior wall finishes must be in compliance with UFC 3-301-01 as listed below.

## Repair Steam Sterilization Plant (SSP)

DB RFP Requirements

Ft. Detrick, MD

Chapter 6

B10 Exterior Enclosure

Concrete panel veneer	L/360*
Cement board	L/360
Gypsum sheathing	L/240

1. Item not provided in the UFC 3-301-01.

Provide watertight expansion and crack control joints with sealant materials in exterior enclosure to prevent moisture infiltration and seepage. Exterior wall envelope including opening panels, and exterior ventilation must also comply with minimum antiterrorism performance level criteria mandated in UFC 4-010-01, Minimum Antiterrorism Standards for Buildings. Exposed sealant used as a watertight joint shall not be accepted.

### B10 1.2 EXTERIOR CLOSURE

Maintain Exterior Closure system as described below.

Reinstall prefabricated concrete panel as the Exterior Closure, with new support frame and exposed interior fasteners.

#### B10 1.2.1 CONCRETE WALL PANEL EXTERIOR CLOSURE

Provide new concrete panel to match existing adjacent system. Existing removed concrete panel section can be reused if in good condition and if method of securing the panel, meets all security and wall requirements.

Exterior concrete wall panel to be secured from the interior of the secured 1SA202 space. New concrete panel to be secured to a new steel frame panel support system that is constructed in the interior space. Wall panels to be fastened at the interior to the new steel frame that are designed to be removable from the secured interior space in the future when access for equipment replacement is required.

#### B10 1.2.2 GENERAL WALL PANEL REQUIREMENTS

Wall system and attachments must resist wind loads as determined by ASCE 7, with a factor of safety appropriate for the material holding the anchor. Limit maximum deflection due to wind on steel framing and supports girts behind concrete wall panels to 1/360 of their respective spans, except that when interior finishes are used limit the maximum allowable deflection to 1/180 of their respective spans. The structural performance test methods and requirements of the wall system and attachments must be in accordance with ASTM E 1592.

Exposed sealant used as a watertight joint shall not be accepted.

#### B10 1.2.3 CONCRETE UNIT MASONRY

Masonry walls must comply with ACI 530.1. Load-bearing units: ASTM C90, Non-load bearing- units: ASTM C129, Type I or II. Provide ground face units, split-faced units, or split-ribbed units for exposed exterior walls. Provide water repellent admixture to masonry units where the exterior face of the units shall not receive a waterproof coating such as paint. Mortar must conform to ASTM C 270, Type S. Test mortar in accordance with ASTM C 780. Provide water repellent admixture and color additive in mortar for masonry walls that shall not receive a waterproof coating such as paint. Do not use admixtures containing chlorides. Provide air entrainment, not to exceed 12 percent, in mortar.

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Adjustable Anchors for Structural Members - Use adjustable anchors to anchor masonry structural steel columns or beams. Weld fixed portion of anchors (steel anchor rods) to structural steel members. Provide adjustable anchors 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel must be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members.

Deformed Bars - ASTM A 615/A 615M, ASTM A 616/A 616M, ASTM A 617/A 617M, or ASTM A 706/A 706M.

#### B10 1.2.4 EXTERIOR WALL BACKUP CONSTRUCTION

Provide new or repair existing Exterior Wall Back-up Construction System to including concrete masonry unit, insulation systems, accessories and joints as described below:

Exterior bearing walls consisting of metal studs as the primary floor or roof supporting structural element are not permitted.

1. Concrete Unit Masonry

Provide concrete unit masonry as described in B10 1.1.2

Provide damp proofing on masonry walls behind metal panels exterior finish.

Provide water proofing on masonry walls behind concrete panel exterior finish no less than four-feet above finished floor preventing snowdrifts and snow melt from causing water intrusion. Coordinate water resistant barrier materials and methods to provide water control and vapor transmission control for the lifetime of the structure. Seal all holes and penetrations in the water resistive barrier and repair any material damaged by other construction operations.

2. Cast-In-Place Concrete System

Unless otherwise noted herein, all concrete design and construction must be in accordance with UFC 1-200-01.

Provide concrete construction in accordance with ACI 318 and ACI 301.

Refer to Performance Verification Testing for Cast-in-place field quality control.

Concrete construction tolerances must be in accordance with ACI 117.

Design for watertight joints, or weeping joints having back-up water penetration protection in precast elements. Minimize cracking potential of precast concrete elements by implementing expansion and control joints in the precast assembly.

Joints must include properly sized and placed backing material and fully loaded and tooled sealant joint of no less than 1/4 inch sealant material thickness.

Provide a water resistive barrier to protect back-up wall assembly.

3. Insulation & Vapor Retarder

Provide continuous insulation, vapor retarder, water-resistive barrier, and air barrier to



meet or exceed requirements of project's energy savings requirements as indicated by applicable American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1 calculations called for in Unified Facilities Criteria (UFC) 1-200-02, High Performance and Sustainable Building Requirements, and meeting minimum building envelope insulation requirements of UFC 3-101-01, Architecture.

Provide a continuous air barrier to control air leakage into, and out of conditioned spaces. Air barrier must encompass all elements of each facility that are exposed to outside environment or outside environmental conditions such as roof, walls, floors, and compartmentalized unconditioned portions of the facility with negatively pressurized spaces. Permanently seal penetrations through air barriers, joints in air barriers, adjoining construction, and transitions to different air barrier materials.

Provide a continuous water resistive barrier in accordance with UFC 3-101-01, Architecture. Water resistive barrier must resist liquid (bulk) water from being absorbed into the back-up wall assembly if water leaks, penetrates, or seeps past the exterior enclosure cladding system.

Include written and graphic descriptions of exterior enclosure barrier materials and location within the wall as a part of Contractor provided design analysis. In the analysis, identify the continuous boundary limits of the air barrier and of the zone or zones to be field tested for building air tightness.

Provide contract drawings that indicate each exterior enclosure barrier location and materials that make up the barriers. Detail the following barrier conditions;

- a. Typical conditions at wall sections.
- b. Barrier treatment at wall openings.
- c. Intersections with other exterior enclosure assemblies and materials. Include intersections at roof and floors.
- d. Intersections with counter flashing.
- e. Inside and outside corners.
- f. Preservation of air and water tightness at anchors for materials that cover the barrier.
- g. Treatment to seal barrier penetrations such as conduits, pipes, electric boxes, and fixtures.
- h. Indicate air barrier perimeter, if facility is segmented into areas that are not within the air barrier envelope.

Provide exterior enclosure materials that are durable and designed to last the life of the facility. Seal continuous air and water resistive barrier in a flexible manner to allow for relative movement of adjacent building enclosure components. Maintain existing exterior enclosure barriers to withstand maximum positive and negative air pressure to be placed on the building without displacement or damage and transfer load to the structure. Permanently seal penetrations, joints, holes, and transitions to adjoining construction in air and water resistive barriers as recommended by the material manufacturer. Do not compromise exterior enclosure barrier integrity at electrical boxes, fixture supports, and fasteners with holes through the exterior enclosure barriers that allow air or water leakage.

Do not expose exterior enclosure barriers or retarders to environment conditions longer than is recommended by the manufacturer.

#### 4. Insulation Systems

Provide vertical and horizontal polystyrene insulation to match existing system as required that conforms to ASTM C578 or rigid polyisocyanurate board wall insulating products conforming to ASTM C591 or mineral-fiber blanket insulation conforming to ASTM C 665. Wall insulating product must have a minimum R-value as indicated by applicable ASHRAE 90.1 calculations called for in UFC 1-200-02, High Performance and Sustainable Building Requirements, and meeting minimum building envelope insulation requirements of UFC 3-101-01 Architecture and the energy design of the facility. Seal the joints in rigid insulation within cavity/veneer walls for additional moisture and air infiltration protection.

#### 5. Air Barrier

When construction new or repairing existing exterior building renovations the existing Building air barrier is to be maintained. Building air barrier is a combination of various construction materials/ components that form a continuous air barrier seal on all six sides of a building. Use methods recommended by manufacture to seal joints and intersections for air-tightness of materials designated as part of the air barrier. Individual materials used in a continuous air barrier must have an air permeance not to exceed 0.004 cfm/ft<sup>2</sup> at a pressure differential of 0.3 inches water (1.56lb/ft<sup>2</sup>), (0.02 L/s. m<sup>2</sup> at 75 Pa) when tested in accordance with ASTM E 2178. If air barrier is to be field tested, refer to requirements in paragraph entitled "Air Barrier Performance Testing" of this section for entire building minimum air permeance. Provide air barrier installation at windows in accordance with ASTM E 2112.

#### 6. Exterior Enclosure Air Barrier Materials

Refer to Air Barrier Association of America (ABAA) to identify qualified materials with the appropriate performance for the air barrier. Utilize materials from the "ABAA Evaluated Air Barrier Materials" found at the following web link; [http://www.airbarrier.org/materials/index\\_e.php](http://www.airbarrier.org/materials/index_e.php)

#### 7. Water Resistive Barrier

When construction new or repairing existing exterior building renovations the existing water resistive barrier is to be maintained. The water resistant barrier is to resist bulk water penetration and wind-driven rain that passes the exterior cladding of the facility. Provide vapor permeable water resistant barrier if the water resistive barrier function is combined with other exterior enclosure barrier functions. Integrate water resistive barriers with wall flashing to form a shingled effect and direct water down the outside surface of the water resistive barrier, away from the back-up wall assembly, and out of the wall. Comply with the requirements of ASTM E2256 for mechanical fastened building wrap materials or ICC-ES Acceptance Criteria AC38 for other materials.

#### 8. Exterior Enclosure Water Resistive Barrier Materials

Refer to Air Barrier Association of America (ABAA) to identify qualified materials with the appropriate performance for the water resistive barrier. Utilize materials from the "ABAA Evaluated Air Barrier Materials" found at the following web link; [http://www.airbarrier.org/resistive/index\\_e.php](http://www.airbarrier.org/resistive/index_e.php)

9. Moisture Barrier/ Vapor Retarder

When construction new or repairing existing exterior building renovations the existing moisture barrier or vapor retarder is to be maintained. Provide a moisture barrier/ vapor retarder to slow or reduce the unintended movement of water vapor in and out of conditioned space.

**B10 1.2.5 EXTERIOR FENESTRATION CONSTRUCTION**

1. Exterior Louvers & Screens

Provide exterior louvers and screens, where required, that match the finish of the existing windows and detailed to integrate with the architecture of the building, as appropriate to the design of the building.

Louvers and screens must be selected in a color and design that is compatible with the fabric of the exterior architectural character as described below. For frame construction, install in accordance with ASTM E 2112.

2. Wall Louvers

Provide drainable blade type wall louvers with blade slopes of 45 degrees minimum, but provide wind driven rain rated louvers for wall louvered rooms without a floor drain within the room. Louvers must withstand a wind load, to meet the requirements of the specified wind load or not less than 30 psf (146 Kg/m<sup>2</sup>), .08 inch (2 mm) thick 6063-T5 or T52 extruded aluminum in a factory-finished color in accordance with AAMA 2605 with a minimum coating thickness of 1.2 mil to match the building facade. Provide recessed mullions for all louvers more than 5 feet in width at not more than 5 feet on centers.

Wall louvers must bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 , 500L (wind driven rain), and AMCA 511. The rating shall show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

Provide sill flashing with sloped drain pan at base of louver to collect moisture that migrates down the interior face of the louver. This sill flashing must drain water to the outside of the building.

3. Wall Louver Screens

Louvers must have bird screens. Provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

4. Wall Flashing

Flashing must be aluminum or stainless steel. Aluminum must conform to ASTM B 209/B 209M, 0.040 inches thick and must be coated to match the item flashed. Stainless steel must conform to ASTM A 167, type 302 or 304, 2D finish, fully annealed, dead soft temper. Thickness must be a minimum of 0.018 inches. Incorporate the flashing in the water resistive barrier and seal joints to flashing to form a shingled effect and direct liquid water to the exterior of the exterior enclosure and away from back-up wall assembly.

**B10 1.2.6 EXTERIOR PAINTING AND COATINGS**

**1. Exterior Painting and Coatings**

Provide field applied exterior coatings for all items that are not prefinished, and to prefinished items when required to provide a color other than a standard prefinished color. Provide special coating systems for exposed structural elements associated with the cantilever system or other exposed structural elements. New paint finish to match existing building components to maintain current building design and color.

**2. Exterior Painting and Special Coatings**

Apply coatings directly to all non-prefinished surfaces of the exterior construction. Comply with Master Painters Institute requirements for surface degradation analysis, surface preparation, paint and coating selection, paint application restrictions for substrate materials, and paint application. New paint finish to match existing building components to maintain current building design and color.

**3. General Requirements**

Painting practices must comply with applicable federal, state and local laws enacted to ensure compliance with Federal Clean Air Standards. Apply coating materials in accordance with Society for Protective Coatings (SSPC) PA 1. SSPC PA 1 methods are applicable to all substrates.

Provide all paint in accordance with the Master Painter Institute (MPI) standards for the exterior architectural surface being finished. The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, shall be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a more current MPI "Approved Product List"; however, only one list may be used for the entire contract. All coats on a particular substrate, or a paint system, must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Select paint systems for the project in accordance with the MPI Architectural Painting Decision Tree available on the Whole Building Design Guide. Use this interactive MPI Decision Tree website to identify applicable paint system(s) for the project. The MPI Decision Tree identifies paint systems for each interior or exterior coated surface in "Normal" or "Aggressive" environmental conditions and generally lists the applicable paint systems in descending order of performance. The paint system at the top of each substrate list generally indicates the highest performing acceptable coating system.

Choose the "Aggressive" environmental conditions in the MPI Decision Tree for exterior systems that are used in moist humid conditions, abrasive conditions, chemical exposure conditions, or within five miles proximity of the ocean or a body of water. Also use "Aggressive" environmental conditions in interior spaces that are exposed to in moist humid conditions, abrasive conditions, chemical exposure conditions, such as bathrooms, shower rooms, kitchens, chemical storage area, swimming pools, laundry, sanitary areas, commercial kitchens, industrial production areas, and hospital operating rooms provide paint systems that comply with the MPI Decision Tree "Aggressive" environmental conditions.

Comply with the following requirements when determining the appropriate paint or coating system from the MPI Decision Tree:

- a. Some of these paint systems are identified with a "NAVFAC Anchor". This "NAVFAC Anchor" indicates the minimum performing system that NAVFAC shall accept for that substrate and environmental conditions.
- b. When multiple "NAVFAC Anchors" are indicated on a certain substrate and environmental condition, provide the "NAVFAC Anchor" paint or coating system that is most appropriate for the facility use.
- c. If only one MPI Decision Tree choice is available for a certain substrate and environmental condition with no indicated NAVFAC preference, provide that sole option for NAVFAC projects.
- d. If the MPI Decision Tree provides multiple choices and no NAVFAC preference is denoted, refer to the Additional RFP Requirements below to determine level of performance.
- e. If the MPI Decision Tree does not identify all paint system applicable to the facility, utilize the MPI Architectural Painting, Exterior Systems Manual to identify other appropriate paint systems for the project. Utilize the "Premium Grade" systems and comply with all limitations stated in the MPI "Approved Product List" for each paint product. Products having an MPI VOC Range E3 must be given preferential consideration over lower VOC Ranges. Use higher performing paint systems unless the lower performing paint system can be justified based on a lifecycle cost to include surface preparation, application, disposal, environmental impact, and required recoating cycles. Only use paint products that have been tested for MPI'S "DETAILED PERFORMANCE" or "EVALUATED PERFORMANCE ". Do not use products that have only been tested for "INTENDED USE".
- f. If an "Aggressive" environmental condition option is not available in the MPI Decision Tree for a certain substrate, use the "Normal" environmental condition option.
- g. Refer to the Additional Exterior Paint and Coating System Requirements below for further system requirements.

Paints and coatings must comply with Master Painters Institute Green Performance Standard GPS-1-12 which is available at the following website: <http://www.specifygreen.com/EvrPerf/EnvironmentalPerformance.html> . Choose paints that provide performance, are environmentally friendly, and that conform to EPA or local environmental regulations, whichever requires the lowest VOC content.

#### 4. MPI Gloss Levels

Gloss levels must comply with the MPI system of determining gloss as defined in the Evaluation sections of the MPI Manuals. Utilize the performance characteristics of the paint gloss and sheen to categorize paint rather than manufacturers' description of the product. The MPI Gloss Levels are indicated by the notation G1, G2, G3, G4, G5, G6, or G7. Ft Detrick only uses MPI Gloss Levels G2, G3, G5, and G6.

The MPI Decision Tree indicates a default gloss level for each paint system, however consider the appearance, anticipated conditions, and need for cleaning when establishing the final gloss level for each coated surface of the project. Comply with the following guidance in choosing the appropriate gloss level.

- a. Use G2 "Velvet-like" Flat for ceilings, residential walls away from human contact and

low traffic areas.

- b. Use G3 "Eggshell-like" in high traffic areas for ceilings and walls, when human contact with the wall is limited, and for dark accent colors.
- c. Use G5 Semigloss for walls, doors and trim for high durability and clean ability and when a surface is expected to have routine human contact.
- d. Use G6 Gloss only in special situations such as for piping identification or special effects.

The MPI gloss and sheen standard values are in accordance with ASTM D523, and are as follows:

<u>Gloss Level Number</u>	<u>Gloss@60 Degrees</u>	<u>Sheen@85 Degrees</u>
Gloss Level 1(G1)–Matte or Flat	Max.5 units	Max.10 units
Gloss Level 2(G2)–"Velvet-like" Flat	Max. 10 units	10-35 units
Gloss Level 3(G3)–"Eggshell-like"	Max. 10-25 units	10-35 units
Gloss Level 4(G4)–"Satin-like"	Max. 20-35 units	Min. 35 units
Gloss Level 5(G5)–Semi-Gloss	35-70 units	
Gloss Level 6(G6)–Gloss	70-85 units	
Gloss Level 7(G7)–High Gloss	More than 85 units	

See specification section 09 90 00 - PAINTS AND COATINGS for paint types and information to be used on specific materials and locations.

#### 5. MPI System Designations and Table Abbreviations

The MPI coating system number description is found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior system

- a. EXT - MPI short-term designation for an exterior coating system on a new surface.
- b. REX - the MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.
- c. DSD - the MPI short-term designation for Degree of Surface Degradation as defined in the Assessment sections in the MPI Maintenance Repainting Manual. Degree of Surface Degradation designates the MPI Standard for description and appearance of existing condition of surfaces to be painted. This DSD classification is used to determine the proper surface preparation necessary for painting.

#### 6. Surface Preparation

Comply with the "Exterior Surface Preparation" section of the MPI Architectural Painting Specification Manual, or the Exterior Surface Preparation" section of the MPI Maintenance Repainting Manual. All suggestive language such as "may" or "should" are deleted from the standard and "must" inserted in its place. Suggestive language such as "recommended" or "advisable" is deleted from the standard and "require" or "required" inserted in its place. The results of these wording substitutions change this document to required procedures. For surface preparation, determine a MPI DSD Assessment of each surface and comply with the MPI Surface Preparation Requirements relating to the assessments. Notwithstanding MPI requirements, clean exterior ferrous metal that is

exposed to weather conditions (wind, precipitation, solar degradation, and humidity) to a SSPC SP 10 level (near white).

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. For existing buildings, use MPI Maintenance Repainting Manual to determine the coatings that need to be removed. Remove deteriorated or loose coatings before repainting begins. Remove oil and grease prior to mechanical cleaning. Program cleaning so that dust and other contaminants shall not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

7. Additional Exterior Paint And Coating System Requirements

In addition to the MPI Decision Tree, comply with the following paint system requirements:

See specification section 09 90 00 - PAINTS AND COATINGS for paint types and information to be used on specific materials and locations.

B10 1.2.7 EXTERIOR JOINT SEALANTS

Provide exterior application of joint sealants to seal joints and prepare for finish material installation.

Provide sealant joint design, priming, tooling, masking, cleaning and application in accordance with the general requirements of Sealants: A Professionals' Guide from the Sealant, Waterproofing & Restoration Institute (SWRI). All sealant must conform to ASTM C 920.

Joints must include proper backing material for sealant support during application, control of sealant depth, and to act as a bond breaker. Use filler boards, backer rods and bond breaker tapes. Provide priming unless specifically not recommended by the sealant manufacturer. Applied sealant must be tooled. Tooling must not compact sealant too less than the minimum sealant thickness required.

See specification 07 92 00 - JOINT SEALANTS for specific types of sealant, sealant information and the specific use locations.

-End of Section-

**CHAPTER 6**  
**B20 Interior Construction**



## B20 INTERIOR CONSTRUCTION

### SYSTEM DESCRIPTION

Interior construction includes interior partitions, interior doors, and fittings.

Provide durable construction appropriate for the building function. Acoustic properties of materials, as well as durability, must be considered during material selection.

### GENERAL SYSTEM REQUIREMENTS

Areas of the Project subject to abuse require that "impact resistant" systems be provided. See "Room Data Sheets, Appendix B and Drawing Sheet A-720 for specific requirements on "Partitions".

#### B20 1.1 PARTITIONS

Refer to Section B30, Interior Finishes, for additional information on Gypsum Wallboard and finishes.

Provide concrete masonry or gypsum board on metal studs partitions as required in UFC 4-211-01N.

Refer to Drawing Sheet A-720 for partition requirements and Room Data Sheets, Appendix B. Where rooms with different partition requirements adjoin one another, provide a combined wall type that meets Scheduled requirements for STC, Fire Rating, Security, and durability as well as finish requirements of both spaces.

For general use, metal studs with GWB and impact resistant GWB unless stated otherwise in Project Program. Reinforce points where doorknobs can strike a wall and anchorage points for wall mounted equipment.

For new containment surround walls, provide full height cmu/gwb walls to be fully sealed, as to restrict passage of air through the containment walls. Wall to be watertight, at the containment areas to prevent the passage of contaminated liquid from the containment area. Containment area partitions to be sealed to meet standard smoke test to prevent the passage of smoke from space to space. The space to meet room tightness integrity test. The room integrity test shall utilize a rig consisting of a blower, manometer pressure gauge and calibrated orifice for the purpose of accurately determining actual room air leakage. With stable relative pressure readings between 0.02" to 0.05" w.c. at adjacent spaces, perform smoke stick testing to determine all potential locations where room air leakage may be occurring. During testing, modify door hardware accessories as required to facilitate appropriate room tightness thresholds. Continue/repeat room air tightness testing until total room air leakage is no more than transfer air allowances shown on the HVAC drawings, +/- 25%

Provide control joints and installation techniques as recommended by the manufacturer. See Section B30, Interior Finishes, for additional information.

Provide painted GWB with access panels at surfaces furred for HVAC, plumbing and other utility services and controls behind wall surfaces.

Acceptable systems where "IMPACT RESISTANCE" (areas subject to physical abuse or wear) is designated in the project program requirements for impact resistance systems include:

#### B20 1.2 FIXED PARTITIONS

Provide fixed interior partitions that extend from finished floor to underside of structure above, where partitions are specifically required by Room Data Sheets and as described on Partition Schedule Sheet A-720. Sound-rated partition assemblies must have a minimum Sound Transmission Coefficient (STC) of 54 in accordance with American Society for Testing and Materials (ASTM) E 90 or ASTM E 413 for frequency data.

Provide fixed partitions, as specified in the Room Data Sheets. Provide partitions as scheduled, using metal studs, GWB, or CMU. Sound-rated partition assemblies must have a minimum Sound Transmission Coefficient (STC) as scheduled. Construct sound-rated bulkheads above partition assemblies for partitions scheduled to continue to the deck above.

New full height, sealed walls to be provided around the containment areas. Walls to be fully sealed to restrict passage of air through the containment walls. Walls to be watertight, around the containment areas to prevent the passage of contaminated liquid from the containment area. Containment walls to be constructed with reinforced CMU to approximately 9'-4" above finished floor. Continuation of the walls, to the underside of the floor construction above, to be constructed with double layer GWB both sides wall, on a metal stud partition system. GYPSUM Wall Board wall above the CMU construction to be properly braced with diagonal stud bracing to the structural above, to provide proper lateral bracing for the wall. The GWB wall construction above shall maintain the wall design to restrict the passage of air while allowing an easier method to provide wall penetrations for new and existing utilities at the upper area. All wall penetrations to be fully sealed to maintain air restriction passage through the wall.

CMU wall to be finished, on both sides, with (2) layers block filler and a high level epoxy wall finish. The GWB wall above the CMU, to be finished with an epoxy paint finish on both sides of the wall. Wall finish to be fully sealed, to provide a water resistant wall finish that can be scrubbed clean without damage to the surface.

### B20 1.3 TESTING

Determine masonry strength in accordance with ACI 530.1. Where fire-rated assemblies are indicated, provide concrete masonry units that have been tested in conformance with ASTM E 119. Provide certificate of compliance to the Designer of Record (DOR) that the materials and assemblies meet the fire ratings indicated on the drawings.

### B20 1.4 MASONRY UNITS TYPES

#### B20 1.4.1 CONCRETE MASONRY UNITS

Units of modular dimensions and air, water or steam cured.

1. Hollow Load-Bearing Units: ASTM C 90, Type I or II, made of lightweight or normal weight aggregate.
2. Fire-Rated CMU: Products must be tested and approved by United Laboratories (UL) according to testing methods described in ASTM E 119, and listed as 2, 3 or 4-hour fire-rated.

#### B20 1.4.2 MASONRY PARTITION MATERIALS

1. Mortar - Provide ASTM C 270, Type N or S for non-shear-wall interior masonry. For Glass Block use Type S, White Portland cement.
2. Portland Cement - ASTM C 150, Type I, II, or III.

3. Masonry Cement - ASTM C 91, Type N, S, or M.
4. Sand - ASTM C144.
5. Grout - ASTM C 476, Fine aggregate for grouting cells / spaces 3" (75 mm) or less, or coarse aggregate for grouting cells / spaces greater than 3" (75 mm). Slump between 8 and 11 inches (200 and 275 mm). Provide minimum grout strength of 2000 PSI in 28 days, as tested in accordance with ASTM C 1019.

#### B20 1.4.3 MASONRY ACCESSORIES

1. Horizontal Joint Reinforcement – Fabricate from cold drawn steel wire, ASTM A 82. Wire must be hot-dipped galvanized after fabrication in accordance with ASTM A 153/ A 153M, Class B-2, 1.5 ounces of zinc per square foot (42.52 g / 0.0929 sq. meter ).
2. Anchors and Wall Ties – Provide of stainless steel, ASTM A 167, Type 304, or zinc-coated steel.
3. Reinforcing Bars – ASTM A 615 / A 615M.

#### B20 1.5 COLD-FORMED METAL FRAMING

Provide Cold-Formed Metal Framing in accordance with provisions of UFC 1-200-01, General Building Requirements, and the International Building Code (IBC).

##### B20 1.5.1 STUDS

Galvanized steel, ASTM A 653 / A 653M, SS Grade 50, G60

##### B20 1.5.2 FRAMING ACCESSORIES

Fabricate steel-framing accessories of the same material and finish used for framing members, with minimum yield strength of 33,000 psi (230 Mpa). Accessories include, but are not limited to, the following: bracing, bridging, blocking, web stiffeners, end and foundation clips, gusset plates, stud kickers, knee braces, girts, joist hangers, reinforcing and backer plates.

Provide permanent metal-to-metal contact separation from stud to electrical conduits, plumbing pipes, and other internal wall system components, such as electrical wires.

##### B20 1.5.3 METAL SUPPORT ASSEMBLIES

Provide steel materials for metal support systems with galvanized coating in accordance with ASTM A 653/ A 653M, G60; aluminum coating ASTM A 463/ A 463M, T1-25; or a 55% aluminum-zinc coating ASTM A 792.

##### B20 1.5.4 SUSPENDED AND FURRED CEILING SYSTEMS, AND WALL FURRING

To meet ASTM C 645 (for GWB).

##### B20 1.5.5 NON-LOAD-BEARING WALL FRAMING / FURRING

ML/SFA MLF (for lath); ASTM C 645, but not thinner than 20 gage, 0.0371 inch (0.942 mm) thickness.

## B20 1.6 GUARDRAILS

Design guardrails in accordance with the International Building Code (IBC), except delete the handrail design load reduction for code exceptions for residential, prisons, industrial, high hazard, and storage facilities. Provide materials in accordance with NAAMM PR, and provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

## B20 1.7 INTERIOR GLAZING

Provide interior glazing of clear glass, double pane safety laminated glass.

Provide setting and sealing materials, stops and gaskets as recommended by the glass manufacturer.

Glazing thickness indicated in the following paragraphs is the minimum acceptable thickness. Provide thicker glazing if required by the code or the manufacturer for the given application.

### B20 1.7.1 GLASS

1. Clear Glass

Type I, class I (clear), quality q4 or q5 for patterned glass.

2. Laminated Glass

Fabricate from two pieces of Type I, Class 1, quality q3 glass laminated together with a clear, 0.030 inch (0.75 mm) thick polyvinyl butyl interlayer. Total thickness must be nominally 1/4 inch (6.35 mm).

3. Tempered Glass

ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), quality q3.

## B20 1.8 INTERIOR JOINT SEALANT

Sealant joint design and application must be in accordance with the general requirements of Sealants: A Professionals' Guide from the Sealant, Waterproofing & Restoration Institute. Refer to manufacturers' recommendations for chemical resistance.

### B20 1.8.1 JOINT SEALANT TYPES FOR INTERIOR WORK

Sealants must be paintable, and must match the color of adjacent surfaces.

1. Vertical Surfaces - ASTM C 920, Type M, Grade NS, Class 25, Use NT.
2. Horizontal Surfaces - ASTM C 920, ASTM D 1190 for traffic surfaces, Type M, Class 25, Use T.
3. Chemical Resistance - Ensure that all sealants are chemically compatible or resistant to adjacent materials, or materials that may come into contact with the sealants in the course of the building life.

## B20 1.9 INTERIOR DOORS

**B20 1.9.1 STANDARD INTERIOR DOORS**

All interior doors must be hollow metal in hollow metal frames.

Provide STC sound rated door assemblies no more than 4 STC less than scheduled ratings of partitions receiving each door. Provide a factory tested, insulated, engineered, metal door assembly including door frame, hardware, and seals necessary to achieve required rating. Install in accordance with manufacturer's instructions. Include continuous sound/ weather seals around the door to create sound control door. Provide sound/ weather seals at the top and both sides that are integral with the door frame and drop down door bottom sound/ weather seals must rest on a metal threshold. After installation, test doors with a flashlight to determine if any gaps in the sound seals allow light to be viewed on the opposite side of the door.

1. Steel Doors

Hardware preparation must be in accordance with Steel Door Institute (SDI) 17, American National Standards Institute/Door and Hardware Institute (ANSI/DHI) A115 and ANSI/SDI 100. Doors must be hung in accordance with ANSI/SDI 100.

2. Standard Steel Doors

American National Standards Institute (ANSI) A 250.8, Level 2, (occasional use, low abuse types such as closet doors without locks); Level 3, (low use, moderate abuse types such as office/storeroom doors); Level 4, (high use, high abuse types such as corridors, stairways, assembly spaces, and main entry doors), with a physical performance level of 'A'. Maximum door undercut must not exceed 3/4 inch (19 mm).

3. Sound Insulated Doors and Frames

Do not require any special sound rated doors unless specifically required by recommendations of a formal acoustical study.

Provide sound insulated door and frame assemblies into rooms requiring wall assemblies to be sound insulated with a Sound Transmission Class (STC) rating as required.

**B20 1.9.2 STANDARD STEEL FRAMES**

ANSI A 250.8. Form frames with welded corners for installation in masonry partitions and knock-down field assembled corners for installation in metal stud and GWB partitions. Frames thickness must be as determined by the door level select. Set frames in accordance with SDI 105. Form stops and beads with 20-gauge steel.

Provide a minimum of three jamb anchors and base steel anchors per frame, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gauge. Secure frames to previously installed concrete or masonry with expansion bolts in accordance with SDI 11-F. Provide mortar infill of frames in masonry walls, and gypsum board compound infill at each jamb anchor in metal frame walls.

**B20 1.9.3 DOOR AND FRAME FINISHES**

1. Factory-Primed Finish. Doors and frames in non-humid, non-corrosive environments must be factory primed with a rust inhibitive coating as specified in ANSI A 250.8. Factory prime doors on six sides of the door

2. Zinc-Iron Alloy Coating (Galvannealed) and Factory Primed Finish
3. Fabricate interior doors and frames (for installation in such rooms as kitchens, laboratories, battery charging, utility rooms and humid areas such as shower/drying areas, areas with frequent floor mopping, or corrosive chemical atmospheres) from zinc coated steel, alloyed type, complying with ASTM A 653/ A 653M. Factory prime doors and frames as specified in ANSI A 250.8.
4. Manufacturer's primer must be compatible with door finish system in C30, Interior Coatings.

#### B20 1.9.4 FIRE DOORS

This paragraph covers all interior fire doors, including all necessary frames, hardware, closing devices, and alarms associated with the door.

##### B20 1.9.4.1 FIRE AND SMOKE DOORS AND FRAMES

Provide in conformance with National Fire Protection Association (NFPA) 80 and NFPA 105. Fire doors and frames must bear the label of UL, Factory Mutual (FM) or WHI attesting to the rating required. Door and frame assemblies must be tested for conformance with NFPA 252 or UL 10C (for positive pressure).

Provide stainless steel astragals complying with NFPA 80 for fire-rated assemblies and NFPA 105 for smoke control assemblies.

#### B20 1.9.5 DOOR HARDWARE

Provide the services of an Architectural Hardware Consultant (AHC), Certified Door Consultant (CDC), or an Electrified Hardware Consultant (EHC) to assist the Designer of Record in preparation of the door hardware schedule and product selection. The hardware consultant must sign and seal the door hardware construction submittal. Provide, as far as feasible, locks, hinges, pivots, and closers from one lock, hinge, pivot, or closer manufacturer's make. All door hardware must be clearly and permanently marked by the manufacturer, on a location to be visible after installation. Modify hardware as necessary to provide features indicated or specified. For necessary hardware items not indicated in these specification sections, provide American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) grade 1 rated hardware.

##### 1. Hardware for Fire Doors

All hardware provided must meet the requirements of NFPA 80 for Fire Doors and NFPA 101 for exit doors. Hardware must bear the label of Underwriter's Laboratories, Inc., and be listed in UL BMD or labeled and listed by another testing laboratory acceptable to the contracting officer. Comply with NFPA 105 for smoke control assemblies.

##### 2. Hinges

Door hinges at high use and abuse areas to be provide continuous hinges. Ante room doors for equipment and cart movement to receive continuous hinges. Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7.

##### 3. Continuous Hinges

Hinges shall be manufactured of clean anodized aluminum and shall be non-handed. Hinges shall be manufacturer of three interlocking components, two hinge leaves and one cover channel. The door leaf and jamb leaf shall be geared together for the entire length of the hinge, and joined by the cover channel. The pin less assembly of three interlocking extrusions shall be applied to the full height of the door and frame mortising. Unexposed wearing metal surfaces shall be coated with dry lubricant. Vertical door loads shall be carried on Teflon bearings through a full 180 degree opening. All hinges shall be the manufacturer's heavy-duty type. Bearings shall be completely concealed in the cover channel. Hinge cover channel shall be monolithic in appearance. Six screw holes shall be concentrated at each end of the hinge and additional screws proportionally spaced along the full length of the hinge. Hinges be fully mortised and shall be the full length of the door. Provide fire rated or listed hinges for rated doors and frames. All hinges to operate to a full 180 degrees. Fasteners supplied shall be 410 stainless steel, plated and hardened. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors shall meet the required ratings without the use of auxiliary fused pins or studs.

BHMA A156.1, Grade 1, 4-1/2 x 4-1/2 inches (108 x 108 mm) with non-removable pin or anti-friction bearing hinges.

4. Door Coordinator

Door coordinator with carry bar shall be Type 21 and shall be provided for each pair of doors equipped with an overlapping astragal. The coordinator may be mechanically operated and shall be capable of holding the active door of a pair open until the inactive door has preceded it in the closing cycle. When used as fire exit hardware, the coordinator and carry bar shall be listed or labeled by a nationally recognized independent testing laboratory.

5. Electric Exit Devices

Electric exit devices shall conform to BHMA A156.3 with factory installed electric lock modification having the capability to lock or unlock from remote location by means of push button, card reader, or other devices as specified. Exit devices shall comply with life safety requirements of NFPA 101.

6. Locks and Latches

For non-residential buildings use Series 1000, Operational Grade 1, Security Grade 2 for stairways, building entrances, corridors, assembly spaces, and other high use interior doors. Use Series 4000, Grade 1 for non-residential locations not using Series 1000 hardware. To the maximum extent possible, locksets, latchsets and deadlocks, and all components thereof, including cylinders and removable cores, shall be the products of a single manufacturer.

7. Mortise Locks and Latches - BHMA A 156.13, Series 1000, Operation Grade 1, Security Grade 2.

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system or temporary construction cores. All strike plates shall have an ANSI strike box, plastic for non-rated frames and wrought for rated frames. Do not furnish double hole strike unless needed. Mortise type locks and latches for doors 44 mm (1-3/4 inches) thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts. All mortise locks shall have 3 peace anti-friction stainless steel latch bolts.

8. Bored Locks and Latches - BHMA A 156.2, Series 4000, Grade 1, or Grade 2.
9. Knobs and Roses - Knobs and roses must meet test requirements of BHMA A 156.2 and BHMA A 156.13.
10. Lever Handles - Provide lever handles in lieu of knobs, as required by DoD Architectural Barriers Act (ABA) Standards. All lever handles must have the freewheeling feature.
11. Door Bolts

BHMA A 156.16. Provide automatic latching flush bolts for double doors with both door leafs active, BHMA A 156.3, Type 25.

12. Closers

Provide the manufacturer's highest grade or heaviest duty closer available. As most door closers meet the requirements of ANSI A.156.4 Grade, additional performance is required. Provide Optional Test PT-1 – for Grade 1 Surface door closers and PT 4 – Test for Optional Features. The closers shall meet the 10,000,000 cycle test and be provided with a ten year warranty.

BHMA A 156.4, Series C02000, Grade 1, with PT 4C, 1-1/2 inch piston, heavy duty forged arm, with full size cover.

- a. Overhead Holders

BHMA A 156.8, Grade 1.

- b. Closer Holder-Release Devices

BHMA A 156.15, Grade 1.

13. Door Protection Plates

Provide armor, mop, and kick plates conforming to BHMA A 156.6. Provide door kick plates on all doors with closers and doors leading to corridors or circulation spaces. Provide armor plates on all doors that receive cart traffic. Provide mop plates on all doors in rooms that have a mop-able floor finish.

- a. Armor Plates

Armor plates shall be Type J101 stainless steel, 36 inches in height, and 2 inches less in width than the width of the door for single doors and 1 inch less for pairs of doors. Edges of metal plates shall be beveled.

- b. Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 10 inches, except where the bottom rail is less than 10 inches the plate shall extend to within 1/2 inch of the cut out. Edges of plates shall be beveled.

- c. Mop Plates



Mop plates shall be Type J103 stainless steel. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. The height shall be 4 inches. Edges of plates shall be beveled.

d. Roller Jamb Guards

Provide roller jamb guards where indicated. Characteristics: Provide stainless steel flush mount tapered door shields as noted. Product designed to fit on door jambs to protect jambs and finishes. Four foot length and roller action allows equipment to move through doorways more freely. Made of stainless steel. Design Standard Manufacturer: Life Sciences Product or equal.

14. Door Stops and Silencers

BHMA A 156.16, Type L03011, three per single door and four per double door.

15. Thresholds

BHMA A 156.21.

16. Door Gasketing

BHMA A 156.22. Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with wood and steel doors for 20-minute, 45 minute C-label, 1-hour B-label and 1-1/2 hour B-label as specified. Color shall be white. Air leakage rate of weather-stripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

**B20 1.9.5.1 LOCKS**

1. Card Reader System

Card reader system shall be an extension of an existing system based on ANDOVER CONTINUUM by Schneider Electric Critical Systems and HID iCLASS contactless smart card readers. See Section D60 SECURITY for description and system requirements. .

2. Exit Devices

Exit devices and exit device accessories shall conform to BHMA A156.3, Grade 1. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware. Trim for devices shall be thru-bolted. Lever trim is to match lockset levers. Exit devices shall be made of brass, bronze, stainless steel, or aluminum material, powder coated, anodized, or plated to the standard architectural finishes to match the balance of the door hardware. Exit devices shall be one manufacturer. No deviation shall be considered.

Series exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. Exit devices shall be non-handed. Touchpad shall extend a minimum of 1/2 of the door width and shall extend to the height of the cross rail housing for a "no pinch" operation. Plastic touchpads are not acceptable. All latch bolts to be the deadlocking type. Latch bolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latch bolts are not

acceptable. Plastic linkage and "dogging" components are not acceptable.

Lever trim shall be solid case material with a breakaway feature to limit damage to the unit from vandalism.

Surface and concealed vertical rod devices shall be UL labeled for fire door applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer. All power supplies shall be of the same manufacturer as the exit device. Provide monitor type strikes where indicated. Removable mullions shall be Type 22 of the box type and shall be used only with those exit devices for which the mullions were manufactured. Mullions shall be furnished with mullion stabilizers of the same manufacturer.

### 3. Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores must have seven pin tumblers. Cylinders must be products of one manufacturer, and cores must be the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets must have interchangeable cores, which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

#### B20 1.9.5.2 KEYING SYSTEM

Provide a master key system for the facility unless more than one tenant/tenant command resides in a facility. Provide a grand master keying system, or great, grand master keying system if multiple tenants or multiple buildings are required. Provide an extension of the existing keying system for existing facility additions. Name the manufacturer of the existing locks, and indicate if they have interchangeable cores. Provide construction interchangeable cores when subcontractors require keys during construction.

Coordinate a keying system meeting. The Contractor's Project Manager, Superintendent, Hardware Subcontractor, Electrical Subcontractor (if keying hardware is electric), Designer of Record, Contracting Officer, Public Works Base Hardware Specialist, and the Using Activity must attend this meeting to establish the keying system for the project. This meeting is intended to identify base limitations, the necessary security, and access control within the facility. The meeting must produce a marked up copy of the floor plan indicating the doors to receive locks and the doors to be keyed together, and any master keying or grand master keying.

#### 1. Keys

Furnish one file key, one duplicate key and one working key for each key exchange and for each master and grand master keying system.

#### 2. Key Cabinet and Control System

BHMA A 156.5. Provide key cabinet with 25% more key hooks than required for interior and exterior doors. Key cabinet to match existing USAMRID Building type and style.

#### 3. Lock Trim

Cast, forged or heavy wrought construction and commercial plain in design.

#### B20 1.9.5.3 TOILET AND SHOWER ACCESSORIES

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Provide the following toilet and bath accessories per drawing A-401 see toilet accessories legend and sheet A-001 SYMBOLS, MOUNTING HEIGHTS & GENERAL NOTES.

This paragraph covers toilet and bath accessories including, but not limited to, soap dispensers, paper holders, towel receptacles, grab bars, and bathroom mirrors.

1. Toilet Tissue Dispensers

Provide surface or recessed mounted dispensers fabricated of stainless steel. Provide one horizontally or vertically mounted double-roll dispenser per toilet compartment, unless otherwise indicated.

2. Combination Paper Towel Dispenser / Waste Receptacle

Provide a recessed or semi-recessed type with a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel and be constructed of 22-gage stainless steel. Provide one per pair of sinks, unless otherwise indicated. Provide the towel compartment door with a tumbler key lock locking mechanism.

3. Sanitary Napkin Disposal Units

Units must be toilet partition or wall mounted of not less than 22 gage stainless steel, with top and bottom hinged access doors. Provide one in each Unisex toilet stall, unless otherwise indicated. Each unit must have leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer.

4. Grab Bars

Provide stainless steel grab bars in accordance with DoD ABA Standards. Provide an 18 gauge, 1 inch grab bar OD Type 304 stainless steel. Provide length as indicated. Provide concealed mounting flange. Provide grab with peened non-slip surface. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

5. Double Robe Hooks

Provide stainless steel two-hook shape with integral wall flange, with a projection not less than 1-5/8 inches (41 mm). Provide hook with concealed wall fastenings, type 304, 22 gauge steel flange and support arm, 16 gauge stainless steel concealed wall plate, and 10 gauge stainless steel cap, secured with stainless steel screws, satin finish.

6. Mirrors

Provide one manufactured framed electro-copper plated mirror per sink, or one full-size mirror for all sinks, unless otherwise indicated. Provide Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of

special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which shall permit normal cutting and edge fabrication.

- a. Mirror, 18 inches wide by 36 inches high

Mirror frame, 1/2 by 1/2 by 1/2 inch stainless steel channel, one-piece frame with 90 degree mitered corners, polished finish. Galvanized steel back, formed edges with integral hanging brackets and concealed locking screws for fasten mirror to wall. Mirror edges protected by filler strips and back protected by full size, shock absorbing, water-resistant, non-abrasive, 3/16 inch thick polyethylene padding. Wall hanger of 20 gauge galvanized steel include support bracing, welded and rigid construction.

7. Soap Dispensers

Provide one soap dispenser per two sinks, with mechanical action dispensing valve. Do not mount soap dispenser on mirror. Surface mounted liquid type must consist of a vertical Type 304 stainless steel tank with holding capacity of 1.2L (40 fluid ounces) with a corrosion-resistant all-purpose valve.

8. Grab Bar, 2 Wall at Shower

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with peened non-slip surface. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

9. Folding Shower Seat

1/2 inch solid phenolic, matte finish one-piece seat; type 304 stainless steel construction: frame, mounting flanges, baseplate, spring and guide bracket. Provide configuration/handling indicated.

10. Shower Curtain and Rod

Provide shower curtain and hooks, size to suit conditions. Provide anti-bacterial nylon fabric curtain. Provide curtain with aluminum grommets on 6 inches on center, and curtain sides hemmed. Provide type 304, 0.09 inch diameter stainless steel spring wire shower curtain hook with snap fastener. Provide Type 304, 18 gauge stainless steel shower curtain rods, seamless construction, with satin finish, 1 inch OD straight and bent as required to meet installation conditions. Escutcheons type 304, 22 gauge stainless steel snap over mounting flange of glass polypropylene 3-1/8 inch diameter, and one-piece shower rod support sleeve.

11. Shelf, Broom Holder, Rag Hook

Provide stainless steel shelf (48 by 8 inch) welded to stainless steel brackets, spring loaded rubber cams mop/broom holders, one per janitor closet. 14 gauge stainless steel rag hooks and 1/4 inch solid stainless steel drying rod, one per janitor closet.

**B20 1.9.5.4 MISCELLANEOUS ACCESSORIES**

**Marker Boards and Tackboards**

Provide marker boards and tack boards as indicated in Appendix B - Room Data Sheets portion of this RFP. Marker boards and tack boards are funded as part of the construction contract.

This paragraph covers all marker boards, tack boards and fastening devices.

1. **Materials**
  - a. Porcelain Enamel - Marker board writing surface must be composed of porcelain enamel fused to a nominal 28 gage thick steel sheet, laminated to a 1/4-inch (6.35 mm) thick core material with a steel or foil backing sheet.
  - b. Cork must be a continuous resilient sheet made from soft, clean, granulated cork, relatively free from hardback and dust and bonded with a binder suitable for the intended purpose. The cork sheet must have a tensile strength of not less than 40 PSI (275.8 kPa) when tested in accordance with ASTM F 152.
  - c. Tack-board Covers - Provide woven fabric or vinyl wall covering over cork tack surface.
  - d. Aluminum - Aluminum frame extrusions must be alloy 6063-T5 or 6063-T6, conform to ASTM B 221, and be a minimum of 0.06 inches (1.5 mm) thick.
  - e. Glass - Provide tempered glass in accordance with ANSI Z97.1 and in conformance with ASTM C 1048.
2. **Marker Board** - Marker board must be a factory assembled, one-piece unit, and have a 28 gauge nominal steel porcelain enamel writing surface and a chalk-tray with end closure. Frame must be aluminum, powder-coated steel, oak, walnut or mahogany.
3. **Tack Board** - Tack boards must consist of a minimum 1/4-inch (6.35 mm) thick natural cork laminated to a minimum 1/4-inch (6.35 mm) thick hardboard, must have an aluminum frame, and be vinyl or fabric covered. Covers must have a Class 'A' flame spread rating of 0-50, and a smoke developed rating of 0-450 in accordance with ASTM E 84.

**B20 1.9.6 IDENTIFYING DEVICES**

Provide interior room identification signs on each entrance to each interior room. Provide signage to identify each space by room number and name.

Incorporate all necessary interior signage as part of the architectural drawings. Interior signage is not collateral equipment. Interior signage must demonstrate complete coordination with the facility design, and FF&E submittals. Provide interior directional signage as required for facility wayfinding. Provide an identifying device at each interior door. Signs must meet Architectural Barriers Act (ABA) Standards requirements. Refer to Unified Facilities (UFC) 3-120-01, Design: Sign Standards, for more information.

This paragraph covers all signs, plaques, and traffic markers.

1. **Sign Assemblies**

The signage system assemblies must consist of three primary elements; a structural rail

(with coordinating rail joiners to increase sign height in the field), removable copy inserts, and interlocking end caps or frame, and trim.

2. Signage Inserts

The signage rails must be designed as to accept ABS plastic signage inserts.

3. Signage Insert Fabrication

The insert is the signage member to which message signage copy in the form of letters, numbers, and symbols must be applied, and must be interchangeable with similar sized rails of any other sign of equal or greater width and height. The ends of the rail and insert assembly must be enclosed by end caps of prefinished 6064T5 extruded aluminum. Inserts must be fabricated from 0.090 minimum ultra-violet resistant thickness extruded ABS Acrylic sheet core with 20.003 polycarbonate non-glare clear cap bonded to the core during the extrusion texturing process.

4. Signage End Caps

End caps must be injection-molded ABS plastic with integral color. The end caps must be interchangeable to either end of each sign type, and any other similar sign of equal height. The end caps must be interlocking mechanically with the inserts, and rail, requiring no tools for assembly. End caps must utilize straight corners (instead of radius corners). Spring clips must be steel. Plastic spring clips are not acceptable.

5. Signage Trim

Optional accessory top and bottom trim frames of prefinished (color as indicated) 6063T5 extruded aluminum must be provided to the signage types indicated.

6. Signage Mounting

Mounting of the modular signage system must include surface mounting with screw-on applications for interior and exterior walls and on selected doors as indicated, at the locations indicated, and other mounting devices as indicated.

7. Graphics Application

a. Tactile Letters and Symbols

Chemically weld tactile letters and symbols to front surface of signage inserts where indicated and where required by DoD ABA Standards. Tactile letters and symbols must be sized as indicated.

b. Braille

Grade II Braille. Provide Grade II Braille inlaid strip as indicated to match sign color.

8. Signage Aluminum Alloy Products

Provide ASTM B 209 for aluminum sheet or plate, ASTM B 221 for aluminum extrusions and ASTM B 26/B 26M or ASTM B 108 for aluminum castings. Provide aluminum extrusions at least 1/8-inch (3.2 mm) thick and aluminum plate or sheet at least 16 gage

thick. Provide aluminum castings of solid aluminum cast certified by AA 46 alloy designation B443.0. Where anodic coatings are specified, alloy must conform to Aluminum Association's alloy designation 514.0 or A514.0.

9. Signage Aluminum Finishes

Provide exposed aluminum finishes with either mill finish, factory finished with anodic coating or organic coating. Anodized finishes must conform to AA 45, Architectural Class I or II, with a coating thickness 0.7 mil or thicker. Organic coatings must be a baked enamel finish with a dry film thickness not less than 1.2 mils, conforming to AAMA 605.2.

10. Steel Products for Signage

Provide ASTM A 36/A 36M for structural steel, ASTM A 167 for sheet and plates.

11. Glass for Signage

a. ASTM C 1036, Type 1, Class 1, Quality Q3

C103004 1.6 Fiber-Reinforced Polyester (Frp)

b. ASTM D 3841, Type Ii, Grade 1

C103004 1.7 Acrylic Sheet

c. ASTM D 4802, Type Iii

C103004 1.8 Polycarbonate Sheet

SAE AMS 3611

**B20 1.9.7 LOCKERS**

Provide metal construction and enamel finish lockers on concrete bases of 6" high. Lockers are funded as part of the construction contract.

1. Steel Clothing Lockers

Provide ventilated, Single Tier Units (unless multi-tier permitted by Project Program), fully framed. Provide galvanized or galvalume shelves and bottoms for all lockers, and fully galvanized or galvalume lockers in locker spaces adjoining shower rooms. Provide full height door stiffeners.

2. Personnel Lockers

Provide Type II, double-tier, Style 1 or 2 lockers in the location, quantities and sizes indicated. Provide locker finish colors as indicated. Lockers shall be 9" wide by 18" deep.

**B20 1.9.8 FIRE EXTINGUISHER with WALL MOUNTED BRACKETS**

Provide extinguisher as required by NFPA 10 & 101 with wall support bracket sized to support fire extinguisher.

1. Multi-Purpose Chemical Fire Extinguishers - Fluidized and siliconized chemical powder extinguishing agent suitable for classes A, B and C fires.
  - a. Construction: Heavy-duty steel cylinder with metal valve and siphon tube with replaceable molded valve stem seal, visual pressure gauge, pull pin and upright squeeze grip. Corrosion and impact-resistant, powder coat finish.
  - b. Color: Red, in accord with OSHA requirements.
  - c. Capacity: 10 LBS.

#### B20 1.9.9 COUNTERS

1. Solid Surface Countertop

Cast countertops with non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments. Prime product may not be coated, laminated or of composite construction. Defects with depth < 0.010 IN shall be considered superficial. Color to be solid.
2. Backing Material - Moisture resistant, medium density fiberboard (MDF) panels or moisture resistant plywood. With No added formaldehyde (NAF)
  - a. Physical Properties, Based on 3/4 IN Thickness, ASTM D1037, Part A:
  - b. Density: 48 LBS/FT<sup>3</sup>.
  - c. Modulus of Rupture: 4,000 PSI.
3. Joint Adhesive - Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.
4. Sealant – Provide mildew resistant sealant, formulated for application with ssp. Sealant VOC content shall be no greater than 250g/L. Color to match SSF.
  - a. At solid colored SSF: Color-Sil by Color Rite; 100 PCT silicone.

#### B20 1.9.10 METAL WALL AND BASE CABINETS

1. Metal cabinets to be constructed of Cold rolled sheet steel: metal to be Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects. Thickness of metal used in construction of cases shall be 1.3mm 18 GA.
2. System Performance
  - a. Conform to recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version.
  - b. Laboratory casework and support framing system shall withstand the effects of the following loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:



- c. Casework, doors, drawers, work surfaces and shelving shall be in compliance with SEFA requirements for the respective casework material.
- d. Work Surfaces: In addition to SEFA test requirements, work surface spans without continuous base cabinet support shall support 244kg/m<sup>2</sup> 50 LB/SF; deflection shall be limited to 1/180 of the length of the span, not to exceed 6.35mm 1/4 IN.
- e. Shelving: In addition to SEFA test requirements:
- f. Shelf spans without continuous support shall support 244kg/m<sup>2</sup> 50 LB/SF.
- g. Deflection shall be limited to 1/180 of the length of the span, not to exceed 6.35mm 1/4 IN.

**B20 1.9.11 DOOR HARDWARE**

Provide cabinet hardware including two self-closing hinges for each door and two side-mounted metal drawer slides for each drawer and pulls for all doors and drawers as follows. All cabinet hardware exposed to view must be ANSI/BHMA 156.9, Grade 1, and comply with the following requirements:

1. Five Knuckle hinges, institutional grade butt hinge with hospital tip. Material to be 302 or 304 stainless steel. Hinge operation to open to 165 degrees and a self-closing feature at less than 90 degrees.
2. Ball bearing drawer slides must have a static rating capacity of 100 lbs. (444 N).
3. Provide adjustable shelving standards with shelf support hardware and Pull-out shelf/slide extension for wall cabinets.
4. Provide heavy-duty magnetic latch and door and drawer roller catch.
5. Provide flush recessed pulls with US28 clear anodized aluminum finish. Length 4 in center to center of screw holes and 1/4 in diameter bat type.
6. Cabinet Door Bumper Pads: Non-staining, non-marring, clear polyurethane pads with pressure-sensitive, adhesive backing for sound and vibration dampening, preventing direct contact between door and cabinet. Pad shall have raised tip in middle of pad.
7. Glides: Provide non-marring material on movable tables. 1 IN diameter min and 5/8 in vertical adjustment.
8. Leg shoes: Provide on legs and table legs to conceal leveling devices, except for tables with casters. Use of a leg shoe which does not conceal leveling device is not acceptable.

**B20 1.9.12 FIRESTOPPING PENETRATIONS**

Provide all penetrations through rated walls and floors with rated material for firestopping penetrations.

This paragraph covers fire-stopping assemblies to include sleeves, caulking and flashing. See Section D20, Fire Protection, for additional requirements.

1. Firestopping

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products that are FM Approval Guide approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements.

2. Fire Hazard Classification

Material must have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material must be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

3. Toxicity

Material must be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and must not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, Polychlorinated Biphenyl (PCB), Methyl Ethyl Ketone (MEK), or other types of hazardous materials.

4. Firestopping Rating

Firestop systems must be UL Fire Resistance Directory listed or FM Approval Guide approved with "F" and "T" rating at least equal to the fire-rating of the fire wall or floor in which penetrating openings are to be protected.

5. Through-Penetrations

Firestopping materials for through-penetrations must provide "F", "T", and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479.

**B20 1.9.13 SPRAYED FIRE-RESISTIVE MATERIALS REQUIREMENTS**

Provide sprayed fire-resistive materials to the building's structural framing components as required by Building Code to prevent structural failure. Spray-resistive material to match existing system and type. See Section D20, Fire Protection, for additional requirements.

1. Sprayed Fire-Resistive Materials

Spray-resistive material to match existing system and type.

2. Quality Assurance

A pre-installation conference must be held with the manufacturer's approved installer prior to the application of the sprayed fire-resistive materials. Products provided must not contain asbestos to comply with 40 CFR 763.

3. Warranty

Provide manufacturer's standard materials and workmanship warranty stating that the manufacturer agrees to repair or replace materials that fail within 2 years, or as required

by the project program, from date of Substantial Completion.

4. Material Composition

Provide sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or Portland cement binders and light-weight mineral or synthetic aggregates mixed with water at the Project site, or provide sprayed-fiber fire-resistive material consisting of factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at a spray nozzle to form a damp, as-applied product.

**B20 1.9.14 FIRESTOPPING PHYSICAL PROPERTIES**

1. Dry Density: 15 lb. /cubic foot (240 kg/cubic meter) for referenced fire-resistance design to attain the ratings indicated, in accordance with ASTM E 605.
2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:
  - a. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch (6 mm).
  - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.
  - c. No reduction in design thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb. /cubic foot (240 kg/cubic meter).
3. Bond Strength: 150 lb. /sq. ft. minimum in accordance with ASTM E 736.
4. Compressive Strength: 5.21 lb. /sq. in. as determined in accordance with ASTM E 761. Minimum thickness of sprayed fire-resistive material tested must be 0.75 inch (19 mm) and minimum dry density must be as specified, but not less than 15 lb. /cubic foot.
5. Corrosion Resistance: No evidence of corrosion in accordance with ASTM E 937.
6. Deflection: No cracking, spalling, or delaminating in accordance with ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delaminating in accordance with ASTM E 759.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. foot in 24 hours in accordance with ASTM E 859.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics in accordance with ASTM E 84 by United Laboratories: flame-spread index of 10 or less and a smoke developed index of 0.
10. Fungal Resistance: No observed growth on specimens in accordance with ASTM G 21.

-End of Section-

**CHAPTER 6**  
**B30 Interior Finishes**

**B30 INTERIOR FINISHES**

**SYSTEM DESCRIPTION**

Interior finishes include wall finishes, floor finishes, wall base finishes, and ceiling finishes.

Provide aesthetically pleasing, functional, durable finishes appropriate to the buildings function. Consider acoustic properties of materials, as well as durability and ease of maintenance during material selection. Maximize the use of sustainable materials.

Color selections require the use of wall and floor finish material accents to enhance the color and appearance of the interior design. Provide a wall and floor color design that includes a minimum of two different accents colors throughout the facility. Submit pattern drawings of the accents design with the interior design submittal.

**GENERAL SYSTEMS REQUIREMENTS**

For finishes, refer to Room Data Sheets see Appendix B.

Provide paint and coating products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification documentation from certification body.

**B30 1.1 WALL FINISHES**

Provide moisture and mildew resistant interior wall finishes throughout. Finishes that are easily maintained, and suitable in accordance with industry standards for the material surface being finished.

**B30 1.2 CONCRETE WALL FINISHES**

**1. Special or Architectural Finishes on Interior Concrete Walls**

Cast-in-place or pre-cast concrete wall finishes include, but are not limited to, abrasive blasted surfaces, colored surfaces, exposed aggregate, grooved surfaces, or tooled surfaces.

**B30 1.3 GYPSUM WALLBOARD**

Conform to specifications, standards and requirements in accordance with Gypsum Association GA 214, GA 216 and GA 224. Provide asbestos free materials only. Provide all Gypsum Wallboard as 5/8" thick, Type X fire rated panels as a minimum. Provide a foil back gypsum board when a vapor retarder is required.

**1. Impact Resistant Gypsum Wall Board**

ASTM DC1629 Level 1,2 and 3 for surface indentation, ASTM E 695 for soft impact, ASTM C473 edge hardness for high density, 5/8 inch (15.9 mm) thick in non-residential construction. Use in high impact areas and where defined in Appendix B Room Data.

**2. Moisture Resistant Gypsum Board**

ASTM C630/C630M, 5/8 inch (15.9 mm) thick in non-residential construction. Use in humid areas or spaces but not as a substrate in tiled areas where wall tile is exposed to

direct moisture contact or condensation accumulation.

3. Cementitious Backing Units

Provide cementitious backer units, 1/2 inch (12 mm) thick, in accordance with Tile Council of North America Handbook; use as a substrate for ceramic tile in wet areas that are exposed to direct moisture contact or condensation accumulation for areas including, but not limited to, tubs, shower enclosures and shower drying rooms. Provide screws specifically designed for use with cement panels.

B30 1.3.1 Gypsum Wall Board Joint Treatment

1. Joint Compound

ASTM C475, Joint compound must be specifically formulated and manufactured for use with and compatible with tape, substrate and fasteners as recommended by the manufacturer. Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Provide premanufactured joints at all structural expansion joints, crack control joints, and change of materials as recommended by the manufacturer and in accordance with GA 216.

2. Fasteners

ASTM C514. Fasteners must be compatible with each type of gypsum board material as recommended by the gypsum board manufacturer and in accordance with GA 216 and GA 224.

3. Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment.

B30 1.3.2 Gypsum Wall Board Level of Finish

1. Level 1

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Plenum areas above ceilings must be finished to GA 214, Level 1.

2. Level 2

Water resistant gypsum backing board, ASTM C630/C630M, to receive ceramic tile must be finished to GA 214, Level 2.

3. Level 3

Walls to receive a heavy-grade wall covering or have textured finish before painting must be finished to GA 214 Level 3. Wherever gypsum board is to receive eggshell (MPI Gloss Level 3).

4. Level 4

Walls without wall wash lighting to receive paint (MPI Gloss Level 2), light textures, or wall coverings must be finished to GA 214 Level 4.

5. Level 5

Unless otherwise specified, all gypsum board walls, partitions must be finished to GA 214 Level 5. Wherever gypsum board is to receive semi-gloss (MPI Gloss Level 5), or gloss (MPI Gloss Level 6) paint finish, finish gypsum wall surface to GA 214 Level 5. Provide joint, fastener depression, and corner treatment. Do not use fiberglass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

### B30 1.3.3 CMU CONCRETE MASONRY UNITS, ACCESSORIES AND FINISHES

1. CMU within containment spaces to be Hollow Non-Load-Bearing Units: ASTM C129, made with lightweight or medium weight or normal weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units. CMU in high containment areas shall be normal weight aggregate only. Aggregates to be 50% sand and 50% #10 screening of stone and dust.
2. Trim, lintels, copings, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 3000 psi minimum.
3. CMU units to be Hollow Load-Bearing Units: ASTM C 90, Type I or II, made of lightweight or normal weight aggregate.
4. Mortar - Provide ASTM C 270, Type N or S for non-shear-wall interior masonry. Masonry Cement - ASTM C 91, Type N or S. ASTM C270, Type S. Test in accordance with ASTM C780. Use Type I Portland cement with blended hydraulic cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C618.
5. Grout - ASTM C 476, Fine aggregate for grouting cells / spaces 3" (75 mm) or less, or coarse aggregate for grouting cells / spaces greater than 3" (75 mm). Slump between 8 and 11 inches (200 and 275 mm). Provide minimum grout strength of 2000 PSI in 28 days, as tested in accordance with ASTM C 1019.
6. Masonry Accessories - Horizontal Joint Reinforcement – Fabricate from cold drawn steel wire, ASTM A 82. Wire must be hot-dipped galvanized after fabrication in accordance with ASTM A 153/ A 153M, Class B-2, 1.5 ounces of zinc per square foot (42.52 g / 0.0929 sq. meter). Anchors and Wall Ties – Provide of stainless steel, ASTM A 167, Type 304, or zinc-coated steel. Reinforcing Bars – ASTM A 615 / A 615M.
7. Control Joints use at non-fire rated construction only use pre-formed rubber material.
8. Provide final finish as scheduled or defined in the Room Data Sheets. Prior to applying final finish on any new CMU wall, confirm all large voids at finish face of CMU are filled in smooth. Apply two coats approved block filler, applied with a squeegee on both coats to assure block finish is pinhole free. Once final coat of block filler has dried and cured the



final finish coat(s) shall be applied. Follow requirements and procedures of specification Section 09 97 00 for Special Coatings.

- a. At containment pit locations provide a urethane base from the finished pit floor to a minimum of 8" above the finished base floor. Provide a tapered epoxy coat at the top of the base to eliminate any exposed edges or ledges at the top of the base. Above the base, in the containment room side, provide a High Build Epoxy finish coating as defined in specification section 09 90 00, to the top of the CMU wall. At the GWB wall finish above the containment CMU wall provide a standard epoxy coating on both sides of the partition.
- b. At containment walls without a pit, provide a urethane base from the finished floor to a minimum of 8" above the finished base floor. Provide a tapered epoxy coat at the top of the base to eliminate any exposed edges or ledges at the top of the base. Above the base, in the containment room side, provide a High Build Epoxy finish coating as defined in specification section 09 90 00, to the top of the CMU wall. At the GWB wall finish above the containment CMU wall provide a standard epoxy coating on both sides of the partition.
- c. At the non-containment side of the CMU/GWB containment wall, provide a base as scheduled in the Room Data Sheets. Above the base, provide a standard epoxy finish to the top of the CMU wall. At the GWB wall finish above the containment CMU wall provide a standard epoxy coating on both sides of the partition.

#### B30 1.4 TILE WALL FINISHES

##### 1. Ceramic Tile Wall System Finishes

Provide ceramic tile wall systems as defined in the Tile Council of North America (TCNA) handbook for ceramic tile installations suitable for the service requirements listed. Install systems in accordance with Tile Council of North America Handbook and American National Standards Institute (ANSI) A108/A118 series standards. Colored epoxy grout with sealer must be provided. Coordinate with ceramic bath accessories for modularity. Include all trim pieces, caps, stops, and returns to complete installation.

- a. Wall tile must be glazed, matte glazed or unglazed finish. Refer to project program for tile type, pattern, and surface texture.
- b. When used in a shower, tile wall finishes must extend from top of shower pan to a minimum, to the underside of ceiling and must surround the shower enclosure.

#### B30 1.5 CORNER AND WALL GUARDS

Corner and wall guards are to be used to provide impact resistant to the wall finish from cart and equipment movement. The guards must include all accessories necessary for a complete installation in the type of wall partition system being used

1. Minimum impact resistance shall be 18 ft-lbs./sq. inch when tested in accordance with ASTM D 256.
2. Stainless steel corner guards shall be fabricated of minimum 0.0625 inch thick material conforming to ASTM A 167, type 304.

3. Stainless Steel wall guards to be a minimum 1/4 inch (6 mm) thick by 4 inch wide extruded aluminum bar with radius edges. NAAMM MFM No.4 finish
  - a. Rail Support Brackets to be Stainless Steel (I or H shape) beam section with radius edges; designed to hold back of rail 3 inches from wall surface. Clear anodized finish. Space not over 30 to 42 inches OC, as required by manufacturer's instructions.
  - b. Fabricate guard rails with radiused internal and external corners, following general plane of wall surface, with rail offsets as required. Terminate ends with a smooth 3 inch radius, ending 1/2 inch from wall surface.
  - c. Provide support bracket at maximum 12-inches from corners and 6-inches from ends of rails.

#### B30 1.6 FLOOR FINISHES

Provide floor finish materials to meet the following requirements;

1. Concrete Sealer Finish

Finish concrete surface smooth enough to meet the minimum requirements of this RFP or the floor finish manufacturer's smoothness requirements, whichever is the most restrictive. Provide 3 coats of the manufacturer's approved sealer for exposed concrete floors that are not required to have an applied floor finish. Colored concrete floor must be a concrete topping with integral color pigment.

- a. Sealer/Hardener - Water-based; clear, non-yellowing, high solids acrylic system, minimum 30 percent solids content.
- b. Immediately prior to substantial completion of the project, apply one coat of sealer/hardener.

2. Urethane Fluid Applied Flooring

Provide Fluid Applied finish as per specification section 09 67 00. Finish floor to be smooth without pits, burrs, bug holes or pinholes. Smooth floor finish to be 100% free of debris or sharp trapped objects on surface. Finish to be with no texture or orange peel finish. Floor finish to meet an ABSL-3 type finish.

Resinous flooring surfacing system to consist of primer, body coat(s) including resin, hardener, aggregate, fillers or flakes. Resinous flooring system to be composed of 1/4" minimum slurry coat, 10 mil minimum DFT top coat and 10 mil minimum DFT Sealer coat. Flooring to be continuous including base. Base to be provided with an integral cove. Wearing surface to be slip resistant.

Total thickness of top coat and all multi-layer top coats must meet chemical resistance criteria as defined by USAMRID for the specific location use of chemicals. A pre-installation meeting with the contractor and owner to define the requirements to be met prior to installation. All floor finishes receiving a resinous coating must meet the manufacturer's moisture content prior to installation. Testing of floor slab to meet requirements of specification section 09 67 00 section 3.2.

**3. Designated means of Egress Pathway Markings**

Provide a painted egress pathway in a contrasting color, a minimum of 44" wide, to define the designated means of egress path to a main egress door from the space. This is to include a designated pathway from each space visible from all mechanical and equipment locations. The designated path to follow the building egress path as defined on the Life safety plan submitted to the AHJ. Location to be coordinated with location of exit egress lighting and exit signage. B30 1.7 Subfloor Preparation

Have third party independent concrete slab testing agent verify that concrete slabs comply with ASTM F710. Minimum values must not be below the following: Concrete floor flatness must meet minimum flatness of FF 60 when tested in accordance to ASTM E1155 - 96(2008). Concrete levelness on slab on grade must meet minimum levelness of FL 45 when tested in accordance with ASTM E1155 - 96(2008). This requirement does not apply to elevated concrete slabs.

**4. Floor Preparation**

Prior to installation of flooring materials the concrete sub-floors are to be dry, free of curing compounds, sweeping compounds, sealers, hardeners, and other materials which could interfere with bonding of adhesive. If curing compounds, sweeping compounds, bond breakers or sealers exist, they must be completely removed by mechanical means and methods, specifically grinding and shot blasting of concrete surface as necessary. Determine adhesion and dryness characteristics by performing bond and moisture tests. Prior to building being conditioned, perform a preliminary moisture test using in situ probe relative humidity testing as specified per ASTM F 2170.

**5. Testing**

All pre-installation moisture testing is to be performed by a qualified independent testing agency. Perform the following test as soon as building is enclosed, watertight, and conditioned, and a minimum of two months prior to floor covering installation.

- a. Moisture Testing: Perform moisture and pH tests as recommended by the flooring and adhesive manufacturers. Perform test starting on the deepest part of the concrete structure. Proceed with installation only after concrete substrates meet or exceed floor covering manufacturer's requirements. In the absence of specific guidance from the flooring manufacturer the following must be the required minimum:
- b. Perform concrete internal relative humidity testing using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete reaches maximum 75 percent relative humidity level measurement.

**6. Additional Preparation**

If tested moisture levels exceed the allowable limits, shot blast the concrete subfloors to including grinding of areas not accessible to shot blasting equipment and install a 100% solids VOC free epoxy moisture and pH control system as recommended by the third party testing agent.

- a. Install cement based self-leveling underlayment over epoxy moisture and pH control system to create a smooth substrate suitable for floor covering and

approved by floor covering manufacturer for use with their products.

- b. Correct conditions that shall impair proper installation.
- c. Fill cracks, joints and other irregularities in concrete with leveling compound.
- d. Do not use adhesive for filling or leveling purposes.

7. Final Cleaning Prior to Flooring Finish Installation

Clean floor of oil, paint, dust, and deleterious substances. Leave floor dry and cured free of residue from existing curing or cleaning agents.

**B30 1.7 WALL BASE FINISHES**

Provide a wall base for transition between floor and wall finish. If no other type of base is required, provide rubber or vinyl straight base at rubber or vinyl cove base at exposed concrete a base to match the floor material at hard surface floors, or as required in the project program.

1. Integral Fluid Applied Flooring (FAF) Wall Base

At areas where a Fluid Applied Floor system or where indicated in the Appendix B - Room Data Sheets, provide an integral self-coving FAF consisting of the same material as FAF floor system. The base material to be designed for vertical application and coved up at the base. Cove base shall be same thickness as the FAF flooring.

2. Resilient Wall Base Finishes

All rubber wall base must be 4 inch (100 mm) high and 1/8 inch (3.2 mm) thick as required unless indicated otherwise. The wall base must include inside and outside corners and must conform to ASTM F1861-98, Type TS. Provide wall base in rolls and not 4 foot lengths.

**B30 1.8 HARDENERS AND SEALERS**

1. Hardened and Sealed Cure Concrete Floors

Harden and seal concrete floors in accordance with the finished floor manufacture requirements. Utilize other methods of concrete curing if the floor finish manufacturer does not recommend a chemical hardener or sealer. Concrete floors that can utilize a hardener-sealer and shall be exposed to traffic must receive a minimum of two coats of hardener-sealer curing agent for dust protection. These hardener-sealer-cured floors must be finished with a curing agent that must penetrate the concrete to permanently seal the floor against moisture and the penetration of contaminants. The curing agent must be non-toxic, non-flammable, and non-combustible and must be installed in accordance with the manufacturer's printed instructions. The finished floor must be dust-free.

**B30 2.0 CEILING FINISHES**

Primary ceiling finish in EDS support areas must be [24 inch x 48] inch by 5/8 inch minimum thickness suspended acoustical panel ceiling system, except provide a suspended gypsum board ceiling in entrance lobby, restrooms and showers. Panels must have a factory-applied standard washable painted

finish or Type IV with factory-applied plastic membrane-faced vinyl.

Paint exposed structural systems in accordance with PTS Section B30 3.0 INTERIOR COATINGS AND SPECIAL FINISHES.

Provide ceiling finishes as indicated in Addendum B Room Data Sheets portion of this RFP.

Refer to B30 3.0 "INTERIOR PAINTING AND SPECIAL COATINGS" for painted ceiling finishes.

#### B30 2.1 ACOUSTICAL CEILING TILES AND PANELS

For typical open office areas, conference rooms, executive offices, provide non-asbestos mineral composition acoustical ceiling panels of Type III with factory-applied standard washable painted finish or Type IV with factory-applied plastic membrane-faced vinyl, Form: 1, 2, or 3. Provide reveal edge tiles unless otherwise noted.

1. For typical humid areas such as toilets, showers, janitor closets, provide non-asbestos mineral or glass composition acoustical ceiling panels bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material with factory-applied standard washable painted finish; and recycled content: minimum of 40%.
2. Provide NRC and CAC ratings as follows:

Minimum NRC

Minimum CAC

Control/display Area

.70

35-39

Lobbies and Corridors

.60

35-39

Toilets

.50

35-39

All other spaces

.50

35-39

Base the tested NRC value on Mounting Type E-400 of ASTM E795.

## **B30 2.2 GYPSUM WALLBOARD CEILING FINISHES**

Conform to specifications, standards and requirements in accordance with Gypsum Association GA 214, GA 216 and GA 224. Provide asbestos free materials only. Provide featured edge gypsum board on all gypsum surfaces that flatness of joints shall be visible, such as up-lighted ceilings, window lighted ceilings, and as recommended by the manufacturer. Provide Type X gypsum board in fire rated assemblies.

1. Regular Gypsum Board

ASTM C36/C36M and ASTM C1396/C1396M. Provide 5/8 inch (15.9 mm) for all projects.

2. Moisture Resistant Gypsum Board

ASTM C630/C630M, 5/8 inch (15.9 mm) thick, tapered edges. Use for ceilings in humid areas. Do not use as a substrate in tiled areas where tile shall be exposed to direct moisture contact or condensation accumulation. Support moisture resistant gypsum board at 12 inches (305 mm) on center.

3. Cementitious Backing Units

ANSI A108.11 and ANSI A118.9, 5/8 inch (15.9 mm) thick; use for adhesive applied ceramic tile in wet areas (shower enclosures, gang shower rooms). Support cementitious backing units at 12 inches (305 mm) on center. Provide screws specifically designed for use with cement panels.

4. Impact Resistant Gypsum Board

Reinforced gypsum panel with imbedded fiber mesh or polycarbonate resin thermoplastic backing, 5/8 inch (15.9mm) thick, tapered edges, in accordance with Structural Failure Test; ASTM E695 or ASTM D2394 and Indentation Test; ASTM D5420 or ASTM D1037. For use whenever gypsum board partitions are allowed for barracks, training facilities, and industrial facilities. Provide metal framing of 20-gauge minimum. Provide fasteners that meet manufacturer requirements and specifications. Impact resistant gypsum board must have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, ASTM E84. Finish with a high strength veneer plaster.

## **B30 2.2 GYPSUM WALLBOARD COMPONENTS**

1. Joint Treatment

ASTM C475, Joint compound must be specifically formulated and manufactured for use with and compatible with tape, substrate and fasteners as recommended by the manufacturer. Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Provide premanufactured joints at all structural expansion joints, crack control joints, and change of materials as recommended by the manufacturer and in accordance with GA 216.

2. Fasteners

ASTM C514, Fasteners must be compatible with each type of gypsum board material as recommended by the gypsum board manufacturer and in accordance with GA 216 and GA 224.

### B30 2.3 GYPSUM WALLBOARD INSTALLATION PROCEDURES

ASTM C1047, Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials. Install as recommended by GA 214, GA 216 and GA 224.

#### B30 2.3.1 Level of Finish

1. Level 3

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Ceilings to receive a heavy-grade wall covering or heavy textured finish before painting must be finished to GA 214, Level 3.

2. Level 4

Ceilings without critical lighting to receive flat paints, light textures, or wall coverings must be finished to GA 214, Level 4.

3. Level 5

Unless otherwise specified, all gypsum board walls, partitions and ceilings must be finished to GA 214, Level 5. Provide joint, fastener depression, and corner treatment. Do not use fiberglass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

Wherever gypsum board is to receive eggshell, semi-gloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

### B30 2.4 SUSPENSION SYSTEMS

1. Suspended and Furred Ceiling Systems

ASTM C645 (for GWB).

Provide steel materials for metal support systems with galvanized coating per ASTM A653/A653M, G60; aluminum coating ASTM A463/A463M, T1-25; or a 55% aluminum-zinc coating. Provide suspended ceiling framing in accordance with ASTM C754, except framing members must be 16 inches (400mm) unless otherwise noted.

### B30 3.0 INTERIOR COATINGS AND SPECIAL FINISHES

Paint all interior exposed surfaces except factory finished items that are not intended for field coating including but not limited to finished metals (copper, stainless steel, aluminum, brass and lead) door hardware, interior grilles, registers, diffusers, access panels, and panel boxes.

Provide special high performance architectural coatings in EDS, Filtration and Tank Storage Room.

All finish coatings must be as indicated in Appendix B – Room Data Sheets.

Apply coatings directly to all non-prefinished surfaces of the interior construction. Comply with Master Painters Institute requirements for surface degradation analysis, surface preparation, paint and coating selection, paint application restrictions for substrate materials, and paint application.

### B30 3.1 INTERIOR COATINGS GENERAL REQUIREMENTS

All paint must be suitable in accordance with the Master Painter Institute (MPI) standards for the interior architectural surface being finished. The current MPI, "Approved Product List" as of the date of contract award, shall be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a more current MPI "Approved Product List"; however, only one list may be used for the entire contract. All coats on a particular substrate, or a paint system, must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Select paint systems for the project in accordance with the MPI Architectural Painting Decision Tree available on the Whole Building Design Guide. Use this interactive MPI Decision Tree website to identify applicable paint system(s) for the project. The MPI Decision Tree identifies paint systems for each interior or exterior coated surface in "Normal" or "Aggressive" environmental conditions and generally lists the applicable paint systems in descending order of performance. The paint system at the top of each substrate list generally indicates the highest performing acceptable coating system.

Choose the "Aggressive" environmental conditions in the MPI Decision Tree for exterior systems that are used in moist humid conditions, abrasive conditions, chemical exposure conditions, or within five miles proximity of the ocean or a body of water. Also use "Aggressive " environmental conditions in interior spaces that are exposed to in moist humid conditions, abrasive conditions, chemical exposure conditions, such as bathrooms, shower rooms, chemical storage area, laundry, sanitary areas and industrial production areas, provide paint systems that comply with the MPI Decision Tree "Aggressive" environmental conditions.

Comply with the following rules when determining the appropriate paint or coating system from the MPI Decision Tree:

1. If the MPI Decision Tree does not identify all paint system applicable to the facility, utilize the MPI Architectural Painting, Exterior Systems Manual to identify other appropriate paint systems for the project. Utilize the "Premium Grade" systems and comply with all limitations stated in the MPI "Approved Product List" for each paint product. Products having an MPI VOC Range E3 must be given preferential consideration over lower VOC Ranges. Use higher performing paint systems unless the lower performing paint system can be justified based on a lifecycle cost to include surface preparation, application, disposal, environmental impact, and required recoating cycles. Only use paint products that have been tested for MPI'S "DETAILED PERFORMANCE" or "EVALUATED PERFORMANCE ". Do not use products that have only been tested for "INTENDED USE".
2. If an "Aggressive" environmental condition option is not available in the MPI Decision Tree for a certain substrate, use the "Normal" environmental condition option.
3. Refer to the Additional Exterior Paint and Coating System Requirements below for further system requirements.

Paints and coatings must comply with Master Painters Institute Green Performance Standard GPS-1-12 which is available at the following website;



<http://www.specifygreen.com/EvrPerf/EnvironmentalPerformance.html>

Provide Interior flat intermediate and topcoats of a maximum of 50 g/L VOC and interior non-flat intermediate and topcoats of a maximum 150 g/L VOC. Choose paints that provide performance and are environmentally friendly by using total VOC budgeting to analyze the total impact of all flat, non-flat and special purpose coatings on the project.

#### 4. MPI Gloss Levels

Gloss levels must comply with the MPI system of determining gloss as defined in the Evaluation sections of the MPI Manuals. Utilize the performance characteristics of the paint gloss and sheen to categorize paint rather than manufactures' description of his product. The MPI Gloss Levels are indicated by the notation G1, G2, G3, G4, G5, G6, or G7. G1 is not used by Navy.

The MPI Decision Tree indicates a default gloss level for each paint system, however consider the appearance, anticipated conditions, and need for cleaning when choosing the correct gloss level for each coated surface of the project. Comply with the following guidance in choosing the appropriate gloss level.

5. Use G2 "Velvet-like" Flat for ceilings, residential walls away from human contact and low traffic areas.
6. Use G3 "Eggshell-like" in high traffic areas for ceilings and walls, when human contact with the wall is expected but limited, and for dark accent colors.
7. Use G5 Semi-gloss for walls, doors and trim for high durability and clean ability and when a surface is expected to have routine human contact.
8. Use G6 Gloss only in special situations such as piping identification or special effects.

The MPI Gloss and Sheen Standard values are measured per ASTM D523, and are as follows:

Gloss Level Number	Gloss@ 60 Degrees	Sheen@85 Degrees
Gloss Level 1(G1) – Matte or Flat	Max.5 units	Max.10 units
Gloss Level 2(G2) – "Velvet-like" Flat	Max. 10 units	10-35 units
Gloss Level 3(G3) – "Eggshell-like"	Max. 10-25 units	10-35 units
Gloss Level 4(G4) - "Satin-like"	Max. 20-35 units	Min. 35 units
Gloss Level 5(G5) - Semi-Gloss	35-70 units	
Gloss Level 6(G6) – Gloss	70-85 units	
Gloss Level 7(G7) – High Gloss	More than 85 units	

#### MPI System Designations and Abbreviations

The MPI coating system number in each Division is found in either the MPI Architectural

Painting Specification Manual or the Maintenance Repainting Manual and defined as an interior system (INT/RIN).

- a. INT designates an interior coating system for new surfaces.
- b. RIN designates an interior coating system used in repainting projects or over existing coating systems.
- c. DSD – the MPI short-term designation for Degree of Surface Degradation as defined in the Assessment sections in the MPI Maintenance Repainting Manual. Degree of Surface Degradation designates the MPI Standard for description and appearance of existing condition of surfaces to be painted. This DSD classification is used to determine the proper surface preparation necessary for painting.

### B30 3.2 INTERIOR COATINGS SURFACE PREPARATIONS

Comply with the "Interior Surface Preparation" section of the MPI Architectural Painting Specification Manual or the "Interior Surface Preparation" section of the MPI Maintenance Repainting Manual. All suggestive language such as "may" or "should" are deleted from the standard and "must" inserted in its place. Suggestive language such as "recommended" or "advisable" is deleted from the standard and "require" or "required" inserted in its place. The results of these wording substitutions change this document to required procedures. For surface preparation, determine a MPI DSD Assessment of each surface and comply with the MPI Surface Preparation Requirements relating to the assessments. Notwithstanding MPI requirements, clean interior ferrous metal to a SSPC SP 10 level (near white) that have aggressive chemical environments (SSPC Zones 3A, 3B, 3C, 3D, and 3E) or waterfront exposure to open structures (SSPC Zones 2A or 2B). Examples of these types of facilities are indoor water training facilities, indoor swimming pools, and open or mostly open waterfront maintenance buildings/ waterfront warehouses/ canopies.

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. For existing buildings, use MPI Maintenance Repainting Manual to determine the coatings that need to be removed. Remove deteriorated or loose coatings before repainting begins. Oil and grease must be removed prior to mechanical cleaning. Cleaning must be programmed so that dust and other contaminants shall not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, must be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

For containment areas and special areas follow the requirements and procedures as defined in specification section 09 97 00 Special Coatings.

### B30 3.3 Additional Interior Paint And Coating Systems

In addition to the MPI Decision Tree, comply with the following paint system requirements:

1. Pavement Coatings

#### INT 3.2 Concrete Horizontal Surfaces

Normal Environmental Conditions; Pigmented

Provide road and parking lot pavement marking in accordance with UFGS Section 32 17

23.00 20, Pavement Markings.

**B30 3.4 SPECIAL COATINGS TO WALLS**

**1. High Performance Architectural Coating (Hipac)**

HIPAC must be a durable, organic system applied to a continuous (seamless) high-build film and cure to a hard glaze finish. They must be resistant to continuous heat and humidity, abrasion, staining, chemicals, and biological growth. Coating must be installed as a complete system, and as recommended by the manufacturer and have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84.

a. Two-component, epoxy-polyamide must be chemical and corrosion-resistant, adhesive, alkali-resistant, and water-tolerant for metal, wood, concrete, masonry surfaces, and painted surfaces where high gloss or glaze type finish, extreme workability and resistance to abrasion and stains is required. Minimum dry film thickness is 3 mils for each of two coats. Furnish Gloss or Semi-gloss finish. Maximum volatile organic compounds (VOC) must be 340 grams/liter.

**2. Single Component, Moisture-Curing Urethane**

Must be a flexible, abrasion- and impact-resistant, use for floors, walls, machinery, equipment and other surfaces where good abrasion resistance, color retention, gloss retention, graffiti resistance and good resistance to acids, alkalis, solvents, strong cleaners and sanitizers, fuel and chemicals are necessary. Can also be used on concrete floors, brick and masonry surfaces (properly conditioned), metals (properly primed), and wood (properly prepared and sealed.) Minimum dry film thickness is 3 mils for each of 3 coats. Use Type I, Aliphatic, for exterior use except for oily or resinous exterior wood surfaces. Use Type II, Aromatic, for interior use.

**3. Impact Resistant Wall Finishes**

Provide textured acrylic architectural coating system: a seamless textured acrylic water-based coating system, having a thickness of at least 20 mils, on surfaces scheduled to receive it. System must be composed of pure acrylic polymers, silica dioxide, ethylene dioxide and pigments. System must have a Barcoll Hardness Index of 38.0 or greater, smoke contribution of 7.0 or less, and have water vapor permeability of 27.5 English Perms or greater when tested in accordance with ASTM E96. (MPI 42) Coating system must have been on the market and successfully used in commercial applications for a minimum of 10 years.

**4. CMU Application**

High Performance seamless interior HighBuild Epoxy wall coating system, as described in specification section 09 90 00 – Paints and Coatings, must be used as an interior wall finish over CMU that has been joint-filled and smoothed with a water resistant block filler system manufactured recommended compound. Coating system to be mold and mildew resistant, flame spread 15 or less per ASTM-E890 004 and have a minimum final film thickness of 7 mils. See specification section 09 97 00 Special Coatings, for requirements and procedures to provide a final finish at containment areas.

5. Gypsum Wallboard Application

High Performance seamless interior acrylic coating system, where identified in the Room Data Sheets, must be used as an interior wall finish over gypsum wallboard. Do not prime or seal the drywall except as specifically recommended by the texture acrylic coating manufacturer. Coating system to be mold and mildew resistant, flame spread 8.5 or less per ASTM-E84 and have a minimum final film thickness of 20 mils.

**B30 3.5 INTERIOR COATINGS INSTALLATION**

Finish may only be installed by factory-qualified applicators in accordance with the manufacturer's printed instructions and recommendations, to fulfill warranty requirements. All coating system components must be products of the same manufacturer.

A minimum of one sample wall application must be provided. Edges at door and window frames must be feathered; hard edges are unacceptable. Upon approval of the sample wall by the project manager, the application must serve as a standard for the remaining work.

The manufacturer's certified representative shall provide an on-site training demonstration of the application and care of the finish for the end-user's facility manager or other representatives.

-End of Section-

## CHAPTER 6

### C10 Process-Effluent Decontamination System

## C10 Process – Effluent Decontamination System

## SYSTEM DESCRIPTION

This Process Engineering section establishes and describes the relevant design scope and redundancies and criteria for the Effluent Decontamination System (EDS) associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. The engineering and design of the EDS system will be the ultimate responsibility of the EDS vendor with input from the successful design build firm and the owner. The successful Design/Build contractor will be responsible to coordinate all of 8100 building aspects and all support utilities with the EDS vendor.

## C10 1.1 GENERAL

## GENERAL DESCRIPTION

The Effluent Decontamination System for this facility consists of the following:

1. **Biowaste Storage Tanks:** Tanks are sized to provide N+1 redundancy. The maximum estimated daily biowaste generated is 46,500 GPD. With a 50% safety factor added to estimate the peak, the design demand is approximately 70,000 GPD. The capacity of each tank is 25,000 gallons; therefore, four (4) 25,000-gallon tanks will be required to meet the N + 1 design philosophy. The storage tank diameter is limited to 7' 0" to ensure that the sloped biowaste drainage from the BSL3 and BSL4 areas can discharge into the top of the tank. Refer to the plumbing drawing P-112 showing that the lowest drainage invert is 8' 2" above the finished floor (AFF). Leak detection shall be provided by the EDS vendor at the tank outlet. Additional leak detection will be provided in the general containment area by the design build contractor. The room leak detection alarms shall be interfaced with the EDS vendor so that all the EDS related alarms are captured in the EDS PLC. Refer to section D40 for the containment area leak detection.
2. **Solids Reduction/Recirculation Pumps:** The solids reduction pumps will be provided with N + 1 redundancy. One pump will operate while the other is in the standby mode. The EDS vendor shall size the pump to ensure solids reduction while guaranteeing adequate sweeping of the solids to the discharge end of each tank. The pump shall utilize a seal that minimizes the risk of leaking while remaining reliable with the anticipated solids load. A barrier seal that pressurizes clean flush fluid across the seal will accomplish this. The barrier system pump shall have a magnetic seal so that leaks from that seal will not occur. In the event that a leak occurs from the barrier fluid piping system the EDS vendor shall provide a containment pan with leak detection for this pump skid.

Using the preliminary waste composition listed in the performance criteria section of the 22 72 00 01 datasheet, the EDS vendor can recommend the elimination of these pumps. The EDS vendor may offer an optional quote credit to remove these pumps if they can demonstrate to the owner, to the owner's satisfaction, that they are not necessary. The EDS vendor's entire system performance warranty shall remain in place with either option.

3. **Filtration Units:** Each filter unit shall be able to handle the processing capability of 3 EDS units operating simultaneously. Therefore, the filtration skid shall be able to process 120 gpm of waste. Since this filtration system is the most critical component in the design, there will be 3 units providing N + 2 redundancy. One filtration unit will be operating at a time, a second unit could be in a decontamination cycle while the third is in standby mode. The EDS vendor shall provide a containment pan and leak detection at each filtration skid. Refer to the datasheet for the filtration mesh size. The filtration screen shall be

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interchangeable for different mesh sizes in order to meet any new requirements. The filtration unit shall be designed with an automatic thermal decontamination cycle utilizing plant steam. The decontamination cycle shall be controlled by the EDS PLC and initiated by approved personnel at the EDS machine interface. In addition to the requirement for an automated filtration unit decontamination cycle, the EDS vendor shall propose a means for the solids in the Filtration Unit to be automatically discharged into the building drainage system after the Decontamination cycle is successfully completed. The removal of the solid waste can be accomplished with non-potable water flushing, screw conveyors, the combination of both, or other means recommended by the EDS vendor. The purpose of the solids handling system is to eliminate personnel contact with the decontaminated waste.

4. EDS Pressurization Pump Skid. The EDS pressurization pumps take suction from the Filtration units and deliver waste to the EDS Tube skid. The Biowaste will be heated to the Decontamination temperature indicated on the datasheet. The pumps will be sized to deliver the required pressure to pump through all the vendor provided interconnection piping, the EDS tube skid and all associated valves including the back-pressure valve used to prevent the heated biowaste from boiling. Additionally, the pressure drop required to send the waste to the building drainage system from the EDS discharge connection by the piping contractor shall be coordinated with the design build engineer and the EDS vendor, so that an adequate EDS pump pressure is provided. A total of four pumps shall be provided, each with the capacity of supplying waste to two EDS tube skids. Thus, N + 3 redundancy will be provided. Two pumps shall be provided with magnetic seals and the other two shall be provided with barrier fluid seals. The purpose of providing two seal technologies is to have the flexibility of utilizing the seal that functions best during operation. Magnetics seals won't leak but could potentially fail due to clogging of solids; however, barrier seals won't fail due to the presence of solids but could potentially leak.
5. EDS Tube Skid: The EDS tube skid heat exchangers flow and temperature requirement are indicated in the specification datasheet and indicated in the EDS System drawing PFD 100. The system consists of the following heat exchangers in the order of the flow path:
  - a. Preheating tube-in-tube heat exchanger,
  - b. Heating tube-in-tube heat exchanger,
  - c. Retention hold tube-in-tube heat exchanger, and finally
  - d. Post cooling tube-in-tube heat exchanger.

The outlet of the retention tube heat exchanger will include redundant temperature transmitters to ensure that the proper decontamination temperature is maintained. The flow rate of the waste and the volume of the retention tube will determine the retention time the waste is held. Biowaste will only discharge to the building drainage system if both the required temperature and retention time is achieved.

Two EDS tube skids will meet the pressing demand of the peak load estimate. A third EDS tube skid will be supplied so that N + 1 redundancy is provided.

6. Heat Transfer System: A separate heat transfer loop including duplex pumps, expansion tank, piping and controls will provide the cooling fluid to the EDS tube skid. The heat transfer fluid will flow on the outside portion of the tube-in tube exchanger and will be at a pressure higher than the biowaste flowing on the inside tube of the tube-in-tube exchanger. This arrangement ensures that any potential leak in the tube-in-tube heat exchanger will

flow into the contaminated waste stream. The heat transfer barrier fluid system shall have a level transmitter to alert the operator if the fluid level reduces in the tank. The heat transfer barrier fluid will be pumped using a magnetic seal to eliminate potential leaks at the pump seal. A heat transfer system will be dedicated to each EDS tube skid. Each heat transfer system shall be 100% backed up with non-potable sparge cooling in the event that the heat transfer system fails.

7. CIP System: The EDS vendor provided CIP skid will include all necessary tanks, pumps and a chemical addition system to clean the entire EDS system if it is required. The CIP skid may also be used to passivate the EDS system in the field prior to start-up of the system. The CIP system shall include the ability to neutralize any waste that is discharged to the building waste system. Two CIP systems shall be provided so that one system will serve as a back-up in the event that the other system is down for maintenance.

#### C10 1.2 GENERAL REQUIREMENTS

Redundancy Concepts: Because of the critical nature of this facility, a high level of systems reliability is required for safe and uninterrupted operation. In addition to the redundancies noted above, there will be component and instrumentation redundancies.

1. Additional component and instrumentation redundancies are indicated below. These redundancies are also shown on the Overall EDS System Flow Diagram PFD100. If there is a discrepancy between the specification, flow diagram or narrative, the more stringent requirement shall apply. Steam pressure pump traps for the Storage Tank decontamination condensate
2. Storage tank level transmitters/level switches
3. Storage tank temperature transmitters
4. Filtration unit temperature transmitters for decontamination
5. EDS system heating exchanger outlet temperature transmitters
6. EDS system retention tube outlet temperature transmitter
7. EDS system discharge outlet temperature transmitter
8. EDS heat transfer loop pumps

Operation Basis: One EDS unit is designed to handle the load of the maximum estimated day without the safety factor. The 40 GPM unit can process the 48,000 gallons within a 20-hour period. The EDS system is most energy efficient when it runs constantly because the EDS start-up utilities requirements is greater than the steady state requirement when the unit is running.

Maintenance: The EDS vendor provided CIP system is provided to clean the system periodically.

All mechanical systems and devices shall be designed to facilitate regular maintenance functions. Adequate service clearance to all equipment shall be provided to facilitate movement of personnel and equipment. Equipment shall be kept out of congested, difficult to reach locations and hazardous areas. Adequate clearance shall be provided at all equipment to enable removal and replacement of equipment, without requiring prior disassembly of the equipment. All instruments requiring calibration shall be accessible from the ground, from a scissors lift, or for a single arm bucket lift.



### C10 1.3 EDS CONTROL SYSTEM

The control system shall encompass all skids, equipment, components, and instrumentation provided within the EDS scope. The process control system for the EDS will be designed, engineered, and provided by the successful EDS vendor. Two PLCs shall be provided with one running in the control mode while the other is mirroring the operating PLC and is in the standby mode. If the PLC in the operation mode experiences a fault that affects the operation of the EDS system, then the standby PLC shall be automatically placed into the operational mode status so that the system operation is not placed in a hold or stop status.

In addition to the local Human Machine Interfaces (HMIs) provided at the control panels, two remote computer stations shall be provided by the EDS vendor. One operator workstation will be in the EDS Control Display Room (ISA204.1) and the other operator workstation will be in the existing B8100 BMS Control Room (INA102). Both locations are secured and environmentally controlled.

During the design phase of the project, cybersecurity UFGS specification 25 05 11 will be provided/referenced. The EDS manufacturer shall adhere to any requirements established in that document. For additional Cybersecurity information, refer to section D60.

Refer to the EDS datasheet attached and the EDS specification section 22 72 00.01 for additional information.

### C10 1.4 UTILITY REQUIREMENTS

Refer to the attached datasheet for the available utilities for operation of the EDS system. The successful EDS vendor shall confirm that the available utilities are adequate to support the operation of the EDS system, otherwise the EDS vendor shall inform the Design/Build team of the required utilities.

Support Utilities for the EDS System consist of the following:

Building Process Waste

Biowaste Vents

Non-Potable Water for Sparging and System flush

Compressed Air for Controls and Tank Air Blow

Low Pressure Steam for Equipment Decontamination

Medium Pressure Steam for EDS Tube Skid

Medium Pressure Condensate for Reuse of EDS Tube Skid Condensate.

Electrical 480 Volts

Electrical 120 Volt UPS - two dedicated services will be provided.

Refer to Plumbing, HVAC, and Electrical sections for additional information regarding the support utilities.

### C10 1.5 COMMISSIONING

Refer to narrative Section H10 for a preliminary commissioning scope description. The final commissioning specifications will be determined when the successful EDS vendor has established the

**Repair Steam Sterilization Plant (SSP)**

DB RFP Requirements

Ft Detrick, MD

Chapter 6

Process Effluent Decontamination System

detailed sequence of operation and will be provided in the Division 1 specification during the design phase of the project.

-End of Section-

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# SECTION 22 72 00 EFFLUENT DECONTAMINATION SYSTEM (EDS)

Description:	EDS	Equipment No.:	To Be Determined
Equipment Layout.:	TBD	Manufacturer:	To Be Determined
Flow Diagram No.:	PFD100		
<b>PERFORMANCE REQUIREMENTS</b>			
Waste Stream for Treatment	Biowaste	Type of Deactivation System	Continuous
Biosafety Level	BSL3/4	Treatment Capacity	40 gpm minimum
Incoming EU Concentration	---	Daily Throughput	70,000 Gal/Day
Sterility assurance level of treated waste through EDS	1 X 10 <sup>-6</sup>	Waste Stream (3% solids)	Bedding, biscuits, Animal waste, hair and toys. 2 ml plastic tubes, sponges, paper towels
Bacteria/Virus/Spores to be Inactivated ( <i>Note 10</i> )	Geobacillus Stearothermophilus	Auto Chemical CIP cycle	Yes
Waste Inlet temperature	25 °C, 45 °C max	Decontamination Temperature	140 °C
Waste Outlet temperature	48 °C, 60 °C max( <i>Note 1</i> )	Outlet Pressure	15 psig ( <i>Note 2</i> )
<b>CONSTRUCTION</b>			
Process Contact Material above 122 C temp (EDS tube skid)	Alloy 2205 ( <i>Note 25</i> )	Electropolish	No
Process Contact Material below 122 C temp	316L SS	Passivation	Yes
Process Contact Finish	Mill	Skid Weights (dry/wet)	VS *
Building Opening restriction	8'-0" x 8'-0"	Seismic Zone	( <i>Note 14</i> )
<b>COLLECTION TANKS (4)</b>			
Capacity	25,000 Gallons	Pressure Rating	Full Vacuum/ 45 Psig
Access Manway	Yes	ASME Certified	Yes
CIP Spray ball	VS *	Drain/Sample Valve	Yes
Insulation (Field installed)	Yes	Materials of Construction	316L SS
Level Transmitters/Switches	Yes both	Tank Diameter ID	10' 0"
Tank Diameter OD	7' 6" max	Tank Type	Horizontal
Outlet Discharge Height	( <i>Note 13</i> )	Manway Orientation	Side
Length	90'	Fabrication	In Field
Sloped Bottom	Yes, 0.01'/1'	Tank Sections	N/A ( <i>Note 11</i> )
Temperature Transmitters (Decon)	Yes, minimum amount to prove Decon	Temperature rating	150 °C

## VS \* - Vendor/Manufacturer to Supply Information

R		Spec. By	SWC	08/19/2022
E		Checked By	KN	08/26/2022
V	ORIGINAL DOCUMENT SUBMITTAL	Approved By	MS	09/16/2022

**Description:** EFFLUENT DECONTAMINATION SYSTEM

Isolation valves for all waste inlets	Yes	Decon. Steam Pump traps	Yes (2) Redundant 20 psig as motive force
Rupture disc	Yes, with alarm	Contained Leak Detection at Pumps traps	Yes
Steam Decontamination	Yes	Thermal Decontamination	Yes, fluid Recirc.
<b>VENT FILTERS (Per Tank) (Note 22)</b>			
Number Required	4	Filter Style	Cartridge
Integrity testing	Out of Place	Filter Type	Code 7
Decon Method	Steam	Filter Sizing	VS *
Auto Steam Inactivation Cycle for Vent Filters	Yes	Filter Pore size	0.2 micron
Housing Material	316 L SS	Gasket Material	EPDM
Filter Housing	Yes	Max. Waste Flow Rate In	120 gpm
Housing Electric Heating Jacket	Yes	Max. Waste Flow Rate Out	105 gpm
Max. Exhaust based on Air Blow	50 scfm	Max. Vent Filter Pressure Drop	3 Psig
<b>BIOWASTE FEED PUMPS (SKID)</b>			
Number of Pumps	4	Seal Type	Mag seal /Barrier Fluid
Sterilization Method (Note 18)	Steam and/or 10% Clorox Chemical Decon	VFD	Yes, Refer to 262923
Maximum Flow Rate	VS *(Note 3)	Sizing	VS * (Note 3)
Materials of Construction	316 L SS	Drainable	Yes
Mag Flow Meter	Yes	Capacity	80 GPM
Contained Leak Detection at Skid	Yes		
<b>BIOWASTE RECIRCULATION PUMPS (SKID)</b>			
Number of Pumps	2	Seal Type	Barrier Fluid system with magnetic seal for Barrier pump
Sterilization Method (Note 18)	Steam and/or 10% Clorox Chemical Decon	VFD	Yes, Refer to 262923
Materials of Construction	316 L SS	Sizing	VS * (Note 4)
Pump Type	Centrifugal	Recirculation Jets	Yes (Note 4)
Pump Manufacturer	TBD	Contained Leak Detection at Skid	Yes
Application	Solids/Liquids Handling	Impeller Design	Intake and exit cutting blades
Disintegrator prior to impeller	Yes	Configuration	Horizontal end suction

**VS \* - Vendor/Manufacturer to Supply Information**

**Description:** EFFLUENT DECONTAMINATION SYSTEM

LIQUID FILTER/STRAINERS (SKID)			
Number Required	3	Filter Style	VS *
ASME Certified	Yes	Filter Type	Wedge wire screen
Sterilization Method (Note 18)	Automatic Steam Decon. Cycle	Filter Sizing Throughput	120 GPM
Maximum Flow Rate	VS *	Filter mesh size	500 micron (Note 15)
Housing Material	316 L SS	Gasket Material	VS *
Solids Handling (Note 5)	Unload Cart	Magnet for hair Pins	Yes
Pressure Gauge	Yes	Level transmitter	Yes
Contained Leak Detection at Skid	Yes	Minimum capacity	60 cu. ft.
Automatic waste handling system	Yes (Note20)		
TUBE SKID HEAT EXCHANGER (Economizer Heating)			
Number Required	1	Type	Tube in Tube
Sterilization Method	Thermal Decon	Sizing	VS *
Maximum Flow Rate	VS *	Drainable	Yes
Material of Construction (Note 25)	Alloy 2205	Economizer Delta T	92 °C (Note 6)
U bend design (Note 17)	Welded Hairpin	Regeneration efficiency	80 %
Contained Leak Detection at Skid	Yes	Inner Piping	2" tubing ASTM A789
TUBE SKID HEAT EXCHANGER (Economizer Cooling)			
Number Required	1	Type	Tube in Tube
Sterilization Method	Thermal Decon	Sizing	VS *
Minimum Flow Rate	VS *	Drainable	Yes
Material of Construction (Note 25)	Alloy 2205	Economizer Delta T	92 °C (Note 6)
U bend design (Note 17)	Welded Hairpin	Regeneration efficiency	80 %
Temperature Transmitters	Yes (2)	Contained Leak Detection at Skid	Yes
3-Way Discharge Valve	Yes, Inlet, Recirc. and Discharge Ports	Inner Piping	2" tubing ASTM A789
TUBE SKID HEAT EXCHANGER (Heat up)			
Number Required	1	Type	Tube in Tube
Sterilization Method	Thermal Decon	Temperature In	117 °C

**VS \* - Vendor/Manufacturer to Supply Information**

**Description:** EFFLUENT DECONTAMINATION SYSTEM

Maximum Flow Rate	VS *	Temperature Out	140 °C
Materials of Construction ( <i>Note 25</i> )	Alloy 2205	Drainable	Yes
Temperature Transmitters	Yes (2)	Contained Leak Detection at Skid	Yes
Steam Pressure Reducing Valve	Yes	Inner Piping	2" tubing ASTM A789
<b>TUBE SKID HEAT EXCHANGER (Retention Tube)</b>			
Number Required	1	Type	Tube in Tube
Sterilization Method	Thermal Decon	Retention time	2 Minutes ( <i>Note 7</i> )
Maximum Flow Rate	VS *	Sizing	VS *
Materials of Construction ( <i>Note 25</i> )	Alloy 2205	Drainable	Yes
Outlet Temperature transmitter	Yes (2)	Temperature Hold	140 °C
Contained Leak Detection at Skid	Yes	Inner Piping	2" tubing ASTM A789
<b>HEAT TRANSFER SKID (3)</b>			
Number Required	3 / one per EDS skid	Pumps	2 per skid
System Pressure	Greater than Biowaste	Pump seal	Magnetic
Materials of Construction	316 L SS	Thermal Expansion Tank	Yes
Contained Leak Detection at Skid	Yes	Tank Level Transmitter	Yes
Heat Transfer Fluid ( <i>Note 24</i> )	10 – 20 % Propylene Glycol		
<b>CIP SKID (2)</b>			
Pumps	2 Redundant	Tank MOC	VS*
Pump VFD	Yes, Refer to 262923	Tank Size	VS *
Chemical tote	2 Acid/Base	Pump Seal	Magnetic
Chemical tote containment	Yes	Space Limitations	Refer to DWG A105
Contained Leak detection at Skid	Yes		
<b>Miscellaneous</b>			
Interconnection piping	Yes, EDS vendor	Single Point Utilities	Yes
Inter Connection wiring	Yes, EDS vendor	Rigging	By Design Build Contractor
Isolation Valves for all Decontamination paths	Yes	FAT/SAT Required	Yes

**VS \* - Vendor/Manufacturer to Supply Information**

**Description:** EFFLUENT DECONTAMINATION SYSTEM

Complete System Warranty		1 Year after SAT		Weld Inspection Documents	Yes ( <i>Note 16</i> )	
Isolation valves for Inlet and Outlet of Skids		Yes		EDS Relief Valve	Yes (Note 21)	
UTILITY SERVICE	Supply Conditions	Available Capacity	Average Operating Load	Peak Load	Connection	
					Size	Type
Compressed Air	90-100 psig	5 scfm 50 scfm tank blow	VS *	VS *	VS *	VS *
Non-Potable Cold Water Sparging or tank flush	40 -60 Psig	80 gpm Max. usage	VS *	VS *	VS *	VS *
Plant Steam Low Pressure	20 Psig <i>(Note 8)</i>	3,850 lbs./hr.	VS *	VS *	VS *	VS *
Plant Steam Medium Pressure EDS	65 -75 Psig	3,500 lbs./hr.	VS *	VS *	VS *	VS *
Plant Steam Medium Pressure Condensate EDS	<i>(Note 9)</i> 20' back pressure	3,500 lbs./hr.	VS *	VS *	VS *	VS *
Drain Effluent Waste	Atm.	160 gpm	40 - 80 gpm	160 gpm (120 gpm with sparge + 40 gpm)	VS *	Floor sink
Vent	Atm.	To Roof	VS *	VS *	VS *	VS *
Electrical Power	460/3/60 200 amps	200 amps	VS *	VS *	VS *	VS *
Electrical Power	120 Volt UPS 2 Feeds		VS *	VS *	VS *	VS *
INSTRUMENTATION AND CONTROLS						
Reference Sections		Refer to D40 Cybersecurity UFC 4-010-06, ECB 2018-11				
Control System		Allen Bradley(preferred) or Siemens, 2 systems, 100% Redundant (Note 23)				
Control Software		VS *				
Operator Interface Terminal		15” Panel View Plus 6 or 7 HMI				
Printer Alarms/Events		Yes				
Control Panel Dimensions		VS *				
System E-stop		Yes				
Common Trouble Alarm		Yes				
Connection to Site control system		No, however, provide for future capability. MODBUS TCP or BACnet/IP to BMS system				
Remote Computer Stations		(2) One in Control Display ISA204.1, One in BMS Control Room INA102.				
Back Pressure control		Pressure PID loop				

**VS \* - Vendor/Manufacturer to Supply Information**

**Description:** EFFLUENT DECONTAMINATION SYSTEM

<b>ELECTRICAL</b>	
References sections	260133, 260000, 262000, 262923
Electrical Area Classification	Non-Classified
Electrical Enclosures	NEMA 4X
Motor Starters	Yes

**Notes:**

1. Discharge waste effluent temperature outlet shall not exceed 48 °C based on waste temperature inlet of 25 °C. Maximum temperature of discharge shall not exceed 60 °C. Provide a sparging system sized to reduce the waste temperature to a maximum of 60 °C if Heat Exchanger economizer system fails.
2. Waste discharge to be lifted 20' prior to discharge into Process Waste system. Approximate 300' piping run. Coordinate exact back pressure requirement during the detail design phase.
3. Size pump for range required for start-up of and continuous Decontamination of waste.
4. Vendor to size recirculation pumps and jet flow rate into tank to sweep solids from the back of the tank to the front. Provide data (either field or empirical) showing that this will be achieved. Engage an engineering firm with a minimum of 3 years experience with Computational Fluid Dynamic (CFD) modeling of fluids mixing in tanks to assist in determining the flow rate required to sweep solid to the discharge side of the tank. The engineering firm providing the CFD modelling shall submit three examples of similar projects with tank mixing for the review of the project team to confirm that they are qualified.
5. Vendor to provide mock-up of how solids handling will be performed.
6. Vendor to design an Economizer delta T at 92 °C. Temperature into steam heat exchanger shall be 117 °C based on inlet temperature to economizer at 25 °C.
7. Skid shall be designed to be capable to hold waste for 5 minutes at reduced flow rate. Vendor to provide maximum duration if 5 minutes is not achievable.
8. Steam will be used for Decontamination of vent filters, tanks, pump skids and filtration skids. Mechanical contractor to supply 20 psig steam for this purpose. No flex hoses shall be used for the supply of decontamination steam to the equipment requiring decontamination. Plant steam is generated by the site and is available at pressure and capacity stated in the Utility table.
9. EDS vendor to provide steam powered pump traps capable of lifting condensate 20' to connect to the building condensate collection system.
10. The EDS vendor shall provide Bio Indicator (ampoule) and Time and Temperature (2 minutes @140 °C) decontamination verification of Geobacillus Stearothermophilus. Verification shall be provided at the Factory Acceptance Test (FAT) and during the commissioning at the site. The EDS vendor to provide testing port in the EDS tube Skid to perform the ampoule test. EDS vendor shall provide additional inlet and outlet ports to allow for field testing waste introduced into the system. The treated waste shall be processed into a container and not released to the environment.
11. Storage tank size is based on largest tank that can be delivered to the site by roadway.
12. The successful design build firm shall coordinate the final equipment layout with the EDS vendor. The EDS vendor will be responsible to ensure that the layout works with the existing building structure. The coordinated layout includes the determination of the stack up of the gravity flow from the storage tank outlet to the filter tank and then the Biowaste feed pumps.
13. EDS vendor shall provide a design that minimizes potential clogging of piping from the tanks to the pumps. This may include water jet flow to flush across the suction nozzle.
14. Refer to Structural section. Risk Category III, Design Category C, Spectral Response Acceleration 0.04s, Component Importance Factor 1.5.
15. Filtration system to be designed so that different mesh screens can be installed to meet the actual operating conditions. For example, the filtration unit shall be designed to accept a larger mesh screen if future conditions deem that it would optimize the system performance based on a change of the waste characteristics. The EDS vendor shall provide their recommendation of mesh size to optimize the EDS system performance
16. All welds, including interconnecting piping, shall be visually inspected by an AWS certified weld inspector. Additional non-destructive testing shall be performed on a minimum of 50% of the welds. If any of the 50%

**VS \* - Vendor/Manufacturer to Supply Information**



**Description: EFFLUENT DECONTAMINATION SYSTEM**

of weld inspection fails, then 100% inspection is required. Refer to division 40 specification for additional weld procedures.

17. The base price for tube skids shall be that all U-tube bends are welded. The EDS vendor shall provide optional pricing of high-pressure tri-clamps at tube skid U-bends to allow cleanout access of the inner tubes. Alternatively, the EDS vendor may offer recommended location of cleanouts tees to enable access to the inner tubes for cleaning out a potential obstruction.
18. The EDS vendor shall provide redundant pressure powered steam pump traps for all equipment requiring steam for decontamination. All pump traps that receive condensate that is in direct contact of the Biowaste shall be piped to three storage tanks for further treatment. Condensate shall be piped to three storage tanks to ensure that condensate can be treated if the other two tanks are not in operation. Provide an isolation valve for branch piping to each tank.
19. All skids, equipment, components, instruments, valves and piping within the EDS shall be designed so that they are able to be decontaminated by thermal and/or chemical means. Valves shall be provided to isolate skids from each other so that they can be decontaminated independently.
20. The EDS vendor shall include a system to automatically discharge the filtered waste into the building drainage system after the Decontamination cycle is successfully completed. The automatic waste handling system shall be designed to eliminate the operator handling of any solid waste. Provide access for manual solids removal in the case of automatic flush failure.
21. The high temperature Biowaste piping shall be protected by a rupture disk followed by a back-pressure valve. (To minimize release as pressure drops after a disk failure) The relief valve shall be routed to a phase separator/liquid capture tank which shall be vented. The purpose of this requirement is to maintain containment of waste if discharged from a safety device.
22. The sizing of the piping from the tank to the vent filters and the piping shall be provided.
23. EDS vendor to provide PLC programming of owner required system validation procedure. Procedure shall include waste recirculation back to tank as a minimum.
24. EDS vendor can offer different heat transfer fluid that meets the heat transfer duty specified. EDS vendor to obtain approval from the owner that the recommended fluid is acceptable.
25. EDS vendor can submit an equivalent alternate material of construction. EDS vendor shall obtain approval for proposed alternate material of construction prior to proceeding.

**VS \* - Vendor/Manufacturer to Supply Information**

CHAPTER 6  
D10 Plumbing

**D10 PLUMBING**

**SYSTEM DESCRIPTION**

The Plumbing section establishes and describes the relevant design scope and criteria for the Plumbing modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. All Plumbing systems installed meet the requirement of the codes, regulations and guidelines listed in Chapter 4 Applicable Criteria.

**D10 1.1 GENERAL**

**GENERAL DESCRIPTION**

The Plumbing systems of this facility that shall be affected by this design consist of the following:

1. Domestic Cold and Hot Water System: Potable water for the NIBC at Fort Detrick is provided from the water treatment plant (WTP) located on the bank of the Monocacy River. Treated water is pumped from the WTP approximately two miles to the NIBC water distribution piping network. Three existing elevated water storage towers are part of the distribution network. The water towers provide emergency water supply in case of failure of the main water supply source at the WTP. One of the towers can be filled from the City of Frederick water main that crosses the NIBC. The water tap to the city water main includes a set of water pumps, backflow preventers and water meter. It should be noted that an agreement between the City of Frederick and the USAG and NIBC allows the USAG to withdraw water from the public source only in case of emergency. Domestic potable cold and hot water piping and domestic water heaters typically serve areas such as public toilets, locker rooms, break rooms, janitor closets, and similar spaces, which may be common to the entire building. The domestic cold water is brought into the building through two separate services and combine prior to the water booster system located in the biocontainment mechanical room. The existing booster pump skid located in the Biowaste Zone is sized for a total of 1,440 gpm at a discharge pressure of 109 psig. The booster pump skid is a quadruplex variable speed drive unit with a single 300 gpm (20%) lead pump and three 720 gpm (50%) lag pumps and a 185 gallon hydro-pneumatic tank. The domestic cold water serving the biocontainment area is supplied from the domestic cold water system. The domestic hot water is supplied from the domestic softened cold water system. Both systems are separated from the domestic water systems by the use of duplex reduced pressure zone (RPZ) backflow preventers at each floor. Both cold and hot water distribution systems serving BSL-3 biocontainment laboratory spaces have additional double check valves on the branches serving the individual suites. The double check valve is installed on the branch outside of the suite penetration. The hot water distribution on the floor is not recirculated due to the concern of returning contaminated water back to the hot water heaters which also serve non-containment areas. The domestic hot water distribution for containment areas is heat traced and maintained at 120 degrees F.
2. Laboratory Cold and Hot Water System: These non-domestic plumbing systems, non-potable hot and cold water piping and non-potable water heaters typically serve biocontainment and non-biocontainment laboratory spaces, Clinic, Vivarium, and cage-washing areas within the building. The laboratory cold water is supplied from the domestic cold water system and is separated by the use of duplex reduced pressure zone (RPZ) backflow preventers. The laboratory hot water is supplied from the domestic softened cold water system and is separated by the use of duplex reduced pressure zone (RPZ) backflow preventers. Both cold and hot water systems serving BSL-3E biocontainment laboratory spaces have additional double check valves on the branches serving the individual suites.

The double check valve is installed on the branch off of the main outside of the suite. The laboratory hot water distribution system is recirculated and maintained at 120 degrees F.

3. **Tempered Water System:** This system supplies all safety showers and eyewashes with tempered water at a temperature of 85 degrees F in accordance with ANSI Z358.1. This domestic plumbing system, tempered water piping and tempered water heaters typically serve biocontainment and non-biocontainment laboratory spaces, Clinic, Vivarium, and cage-washing areas and other spaces requiring safety equipment within the building. The system is supplied with potable cold water and the tempered water heater is supplied from the domestic softened cold water system. Both systems are separated from the domestic water systems by the use of duplex reduced pressure zone (RPZ) backflow preventers. Tempered water distribution systems serving BSL-3E biocontainment laboratory spaces have additional double check valves on the branches serving the individual suites. The double check valve is installed on the branch off the main outside of the suite penetration. The tempered water distribution system is recirculated and maintained at 85 degrees F.
4. **Water Softener System:** The current water softener system serves the softened cold water system that supplies softened cold water to hot water systems, HVAC humidification, animal watering and purified water makeup only. The hardness of the NIBC water available for the B8100 building is in the range of 162-174 parts per million (ppm) of  $\text{CaCO}_3$ , which indicates hard water. The water softening system consists of a triplex softener system with a brine day tank all located in the Biowaste Mechanical Room. A bulk salt storage silo and brine maker is located outside B8100 to the southwest at the service yard. Brine is piped from outside to the softener day tank located in the Biowaste Mechanical Room to provide brine upon low level in the tank.
5. **Sanitary Waste and Vent System:** Sanitary waste from the existing NIBC at Fort Detrick is conveyed by gravity to the existing site lift station and pumped to the existing waste-water treatment plant (WWTP) located on the bank of the Monocacy River. After treatment, wastewater is discharged to the river approximately 2,000 feet downstream from the water intake. Sanitary waste exits B8100 in multiple locations around the building. In the Biowaste Mechanical zone area there are; a 4" drain leading to the north, a 4" drain to the west and a 10" drain to the west. There is an existing 10" sanitary sewer running outside the west side of the building collecting waste from Building 8100. The sewer has an approximate maximum capacity of 600 gpm flowing half full.
6. **Biowaste and Vent Systems (including HEPA Venting):** Biocontainment laboratory or bioeffluent waste for the site is currently being decontaminated in an existing Temporary Effluent Decontamination Plant located next to the building loading dock area at the southeast. The existing site steam sterilization plant located at the southwest boundary of Fort Detrick has been decommissioned and was replaced with a new Steam Sterilization Plant (SSP) B8150, which is adjacent to the USAMRIID Replacement B8100 and NIAID IRF facility. The new EDS system being proposed shall treat liquid biowaste from B8100 and replace the B8150 SSP. Biowaste is currently collected at the ceiling of the Biowaste zone and conveyed by an existing gravity Biowaste piping system that directs the waste to the existing Building 8150 SSP. The existing BSL3E and BSL-4 waste systems are separate systems until they tie-into the existing parallel mains which start as 6" and increase to 8" in the existing Biowaste zone and continue to the Building 8150 SSP through the existing 8ft x 8ft tunnel below the 1st floor. The existing waste piping is sloped at a minimum of a 2% slope. Fixtures located within the same biocontainment level are provided with deep seal traps prior to discharge to the bioeffluent waste line. Final trap seal depth is 12 inches for BSL-4, and 7 inches for BSL-3E and Aerobiology. Cleanouts in the drainage piping extend up into the containment area above. Cleanouts are provided to isolate each suite as well as the normal code required cleanouts. It was anticipated that the waste from

the sterilizers shall be quenched to about 200 degrees F, and the biowaste piping from those areas may reach that temperature. Also, the option to steam sterilize the biowaste piping resulted in the biowaste piping mains being provided with expansion offsets to allow for minor expansion and flexibility. The existing biovents from BSL-3E are located at the Mechanical Room above that floor with 2 HEPA filters installed in parallel. All the existing BSL-3E vents are collected and run to an existing secondary 2 HEPA filters installed in parallel before discharging through the roof. The existing BSL-4 vents are located at the 3rd floor HEPA well above the BSL-4 area with 4 HEPA filters installed with parallel pairs of 2 HEPA filters in series (Total 4). Those existing vents are then collected and run up through the roof.

7. High Pressure Compressed Air System: The existing compressed air system is a triplex (3) system with a capacity of 425 scfm at 90 psig delivery pressure at the outlets. The compressors are each rated for 215 scfm with two (2) handling the anticipated load in an N+1 arrangement. The two (2) existing dryers are twin tower desiccant type in an N+1 arrangement and a capacity of 425 scfm each. There is an existing 500 gallon receiver. The existing system serves the ABSL-2, BSL-3E and BSL-3 areas as well as providing some air for BAS controls. Existing HEPA filters are provided for the BSL-3E area with 2 HEPA filters installed in parallel. Existing HEPA filters are provided for the BSL-4 area with 4 HEPA filters installed with parallel pairs of 2 HEPA filters in series (Total 4). Existing compressed air purity is a maximum of 3 micron particulate size, less than 1 PPM hydrocarbon content and maximum dewpoint of 10 degrees F.

Description of changes to the existing systems shall be as follows:

1. Domestic cold and hot water shall be provided to the new plumbing fixtures in the Toilet/Locker room area. A new water softener shall be provided to soften the B8100 cold water to provide softened water to the containment area for washdown to the biowaste system, thus reducing the scaling in the EDS biowaste treatment system due to the high temperatures for disinfection of the wastewater. A curb shall be provided around the softener skid and the associated floor drain to contain any water spillage from the equipment.
2. Tempered water shall be provided for the new safety showers.
3. Laboratory cold water shall be provided to the EDS Biowaste Treatment system for washdown and flushing.
4. High pressure compressed air shall be supplied to the EDS Biowaste Treatment system for controls and to some mechanical system valves for controls.
5. Sanitary waste shall be extended to the new plumbing fixtures in the Toilet/Locker room area as well as for floor drains for mechanical and plumbing equipment.
6. The biowaste drain piping at the ceiling of the first floor shall be demolished after the duplex stainless steel p-traps and repiped into separate BSL-3E and BSL-4 biowaste piping systems in Type 316L stainless steel at a slope of 1% and be routed to the new collection tank waste BSL-3E and BSL-4 biowaste manifolds of the EDS Biowaste Treatment system.
7. Biowaste from the showers in the locker room area shall be directed to a new biowaste liftstation and pumped into the biowaste piping system at the first floor ceiling.
8. New biowaste vent piping shall be provided with HEPA vent assemblies and routed up to the roof. All the vent piping including the runs up to the roof after the HEPA filters will be

Type 316L stainless steel.

9. Biowaste Pneumatic Ejector: A new ejector shall be provided to collect the biowaste from the showers in the locker room area adjacent to the new EDS system. The waste shall be collected with a double walled underslab drainage system to the receiver tank and be pumped using air operated double diaphragm pumps to lift the waste into the biowaste drainage system which empties into the new biowaste collection tanks.

#### D10 1.2 GENERAL REQUIREMENTS

Redundancy Concepts: Because of the critical nature of this facility, a high level of systems reliability is required for safe and uninterrupted operation. For this reason, many mechanical systems are designed to include redundant equipment intended to maintain system operation to support this goal. This arrangement is termed "N+1", where N is the number of operating pieces of equipment to provide full system capacity. The "+1" refers to a spare unit that can be brought online when a system component is out of service for routine maintenance or is non-operational.

Systems that have this N+1 redundancy approach include:

1. Existing main water service has two (2) supplies with reduced pressure principal backflow preventers.
2. New water softener shall have three (3) softener tanks with two (2) handling the anticipated load with the third in regeneration or standby mode.
3. Existing air compressors have three (3) compressors with two (2) handling the anticipated load with the third in standby mode. The dryers and filters have two units with one (1) handling the anticipated load.
4. BSL-3E biovents have two (2) HEPA filter housings installed in parallel, each designed for full capacity.
5. BSL-4 biovents have four (4) HEPA filter housings installed in two (2) parallel sets of two (2) housings in series, each designed for full capacity.

Operation Basis: The EDS is a continuous process which requires the SSP to typically operate 24 hours a day, 7 days a week or when agent research activities are present in BSL-3E or 4 spaces

Flexibility: The design of the existing systems includes a 10% factor to provide flexibility requirements. This capacity is built into the equipment and main branches of the piping distribution system.

Maintenance: Access is being defined as that which enables a fixture, appliance or equipment to be reached by means that first required the removal or movement of a panel, door or similar obstruction and possibly requiring the use of a portable ladder, step stool or lift. All systems and devices shall be designed for access to facilitate regular maintenance functions. Adequate service clearance to all equipment shall be provided to facilitate movement of personnel and equipment. Equipment shall be kept out of congested, difficult-to-reach locations and hazardous areas. Adequate clearance, as defined by manufacturer's minimum clearance requirements, shall be provided at all equipment to enable removal and replacement of equipment, without requiring prior disassembly of the equipment. Where possible pipes shall be grouped together on common support channels maintaining a minimum of 2" between piping or inline components. Valves shall be accessible for maintenance and emergencies.

### D10 1.3 LOAD CRITERIA

#### D10 1.3.1 DOMESTIC COLD AND HOT WATER SYSTEM:

Flow based upon water supply fixture unit valves and Hunter's Curves.

#### D10 1.3.2 LABORATORY COLD AND HOT WATER SYSTEM:

Flow based upon water supply fixture unit valves and Hunter's Curves with addition of equipment gpm flowrate.

#### D10 1.3.3 TEMPERED WATER SYSTEM:

Flow of 20 gpm for a safety shower, ½ gpm for eyewash.

#### D10 1.3.4 WATER SOFTENER SYSTEM:

Flowrate is total of existing building cold water load with the additional EDS system equipment demand.

#### D10 1.3.5 SANITARY WASTE AND VENT SYSTEM:

System demand is calculated utilizing drainage fixture units and the Hunters Curve.

#### D10 1.3.6 BIOWASTE AND VENT SYSTEMS (INCLUDING HEPA VENTING):

System demand is calculated utilizing drainage fixture units and the Hunters Curve along with equipment discharge flowrates.

HEPA filter and housing sized for displaced air flow of the maximum anticipated liquid flow at a clean pressure differential of a maximum of 1 inch water column or as required by the design of the Biowaste and vent piping system.

#### D10 1.3.7 BIOWASTE EJECTOR SYSTEM (FOR SHOWERS):

Flowrate based upon drainage fixture units and Hunter's curve. Basin volume based upon maximum 20 starts per hour on the pump. Pumped waste piping shall be sized at between 3 to 9 fps.

#### D10 1.3.8 HIGH PRESSURE COMPRESSED AIR SYSTEM:

Flow based upon EDS or Mechanical Equipment flow requirements.

### D10 1.4 ANTI-TERRORISM / FORCE PROTECTION (AT/FP):

AT/FP requirements, including equipment supports and shutdown controls, shall be considered in the design. Reference to UFC 4-010-01.

### D10 1.5 ACOUSTIC AND VIBRATION CRITERIA

Acoustical and vibration treatment shall be provided for all system components, to maintain specified space noise criteria. All noise and vibration criteria are in accordance with general data indicated in UFC 3-450-01. Provide minimum 4-inch thick concrete housekeeping pads and vibration isolators under all floor-mounted equipment with motors with a minimum 6-inch clearance.

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Vibration isolators and flexible connections shall be provided for all rotating equipment such as pumps, fans, and similar motorized equipment. Vibration isolation hangers shall be provided within 50 feet of pumps.

Seismic Criteria: All elements of the systems shall be installed to withstand seismic forces as required by UFC 3-420-01.

### **D10 2.1 SYSTEM DESIGN CRITERIA**

#### **D10 2.2 GENERAL CRITERIA**

Pipe guides, anchors, expansion loops, supports, expansion joints, vents, drains, controls, and similar shall be provided where required for all piping systems to limit piping thermal deflection to 1-1/2" per run, or an amount not visible as a mis-alignment in the piping run as determined by the USACE Quality Assurance representative.

Gauges, thermometers, gauge cocks, thermos-wells, shut-off valves, control valves, and other devices shall be provided for each piece of equipment for operation, maintenance and balancing purposes.

Installation of inline valves and components shall consider the ability to service devices in-line or have the ability for easy removal or replacement without cutting piping.

Valves shall be provided on all branches off mains and be accessible for operation and maintenance.

If required existing pressure service, drainage and vent piping shall be relocated or re-arranged to allow for coordination of the revised biowaste drainage piping routing or for coordination with mechanical ductwork or equipment access aisles.

All piping systems shall be cleaned and flushed prior to final testing and commissioning.

All piping system shall be tested per ASME and Codes, Standards and Guidelines in excess pressure and corrected for leakage. Plumbing systems shall be design for compliance with the 2018 International Plumbing Code and the codes and standards listed in the Codes narrative.

All hydronic systems shall be balanced for occupied mode peak required design flow rate and pump head. Balancing reports shall be provided and approved by USACE. Balancing shall be performed by an independent agency, approved by USACE.

Critical spare parts shall be identified, and numbers of spares identified for storage.

Water piping shall be sanitized after successful testing. If necessary, it shall be re-sanitized within 6 weeks of turnover to owner.

#### **D10 2.3 DOMESTIC COLD AND HOT WATER SYSTEM:**

The existing building domestic cold and hot water distribution system shall provide cold and hot water to the Toilet room, Shower Out and Janitors Closet areas.

Double check valves shall be provided on all new branches off the mains. Two double check valves installed in parallel shall be installed for redundancy to avoid shutdown of equipment.

Piping Sizing Criteria: Average Piping Pressure drop: 3 psi per 100 ft. Maximum Piping Velocity: 7 feet per second for cold water, 5 feet per second for hot and softened water.



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Minimum pressure at outlet: 35 psig.

Piping Materials: Type L copper tubing, ASTM B88, with wrought solder joint fittings.

Insulation: minimum 1" thick flexible elastomeric cellular for cold, fiberglass for hot with PVC jacket.

Valves: Lead-free brass 3-piece full port, extended handle.

Double check valves: Lead-free brass with test ports.

Plumbing fixtures shall be commercial grade and comply with the requirements of the plumbing code and UFC requirements.

**D10 2.4 LABORATORY COLD AND HOT WATER SYSTEM:**

The laboratory cold and hot water distribution system shall provide cold and/or hot water to the EDS equipment.

Double check valves shall be provided on all new branches off the mains.

Piping Sizing Criteria: Average Piping Pressure drop: 3 psi per 100 ft. Maximum Piping Velocity: 7 feet per second for cold water, 5 feet per second for hot and softened water.

Minimum pressure at outlet: 35 psig.

Piping Materials: Type L copper tubing, ASTM B88, with wrought solder joint fittings.

Insulation: minimum 1" thick flexible elastomeric cellular for cold, fiberglass for hot with PVC jacket.

Valves: Lead-free brass 3-piece full port, extended handle.

Double check valves: Lead-free brass with test ports.

**D10 2.5 TEMPERED WATER SYSTEM:**

Tempered water shall be supplied to any new safety showers or eyewashes from the existing building tempered water system.

New valved connections off the existing mains in the Biowaste Mechanical room area shall be provided.

Piping Sizing Criteria: Average Piping Pressure drop: 3 psi per 100 ft. Maximum Piping Velocity: 5 feet per second.

Minimum pressure at outlet: 30 psig.

Piping Materials: Type L copper tubing ASTM B88 with wrought solder joint fittings.

Insulation: minimum 1" thick fiberglass with PVC jacket.

Valves: Lead-free brass 3-piece full port, extended lockable handle.

Double check valves: Lead-free brass with test ports.

Safety shower and eyewash units shall comply with ANSI Z358.1, plumbing code and UFC requirements.

For safety showers in containment areas provide flow alarm and light as required by the Ft. Detrick Design Criteria Section 5-09.A.

#### D10 2.6 WATER SOFTENER SYSTEM:

A new water softener matching the existing water softener is being supplied to soften the cold water going into the BSL-3E and BSL-4 areas. Due to the complexity of the existing piping the project shall soften all the water for B8100. The project shall divert the existing 6" CW feed to the building after the split to the existing water softener and route that feed to the new softener and finally route the softened water back to the existing CW supply point.

Pipe Materials: Water piping material are the same as for domestic cold water. Brine piping is schedule 40 FRP fiberglass with bonded socket joints. Drain piping material is DWV copper tubing with wrought DWV solder joint fittings.

Equipment shall be placed upon concrete housekeeping pads and have adequate clearances around it for service. Curbing shall be provided around the new softener equipment to contain spilled water from the system. The floor sink shall be sized and indirect waste drain piping arranged to avoid splashing and spilling of water on the floor.

Water softeners shall be sized for a service flow range of 200 gpm continuous flow and 700 gpm maximum flow. The system shall be sized as a minimum of three (3) softener tanks in an N+1 arrangement sized for the identified flows. More than 3 softener tanks in an N+1 arrangement may be used to reduce the peak regeneration wastewater flow.

Controls shall be by the softener manufacturer and be tied into the existing building 8100 BAS system. Controls for the softener shall be integrated with the existing softener and brine maker controls to allow them to operate as one integrated system.

#### D10 2.7 SANITARY WASTE AND VENT SYSTEM:

Sanitary waste and vents shall be provided for the toilet room fixtures and be extended to the existing systems.

Vent piping is sized based upon a positive or negative pressure of 1" water column.

The minimum pipe size below grade is 2", and the minimum pipe size above grade is 1.5".

The minimum design velocity is 2' per second.

The minimum pipe slope is 2% for piping 2" and smaller, and 1% for piping 3" and larger.

Piping is sized based upon flowing half full.

Pipe materials: Standard weight cast iron pipe, hub and spigot joint fittings below grade, no-hub fittings above grade.

Floor drains shall be provided where required for mechanical equipment drains. Locate drains so minimal drain piping is running above the floor creating tripping hazards. No floor or trench drains are to be provided in the EDS system and tank areas.

Floor drains are not provided for emergency showers/eyewashes per Fort Detrick Regulation 200-7, Section 4-7.g (5).

#### D10 2.8 BIOWASTE AND VENT SYSTEMS (INCLUDING HEPA VENTING):

Biowaste drainage shall be provided for the new showers and floor drains in the new Changing Room and Shower Out area and the mop receptor in the Janitors Closet.

Sizing criteria based upon similar criteria as Sanitary Waste and Vent.

Additional sizing criteria for flows to include equipment gpm flow.

All existing BSL-3E and BSL-4 drainage piping downstream of the duplex stainless steel p-traps within the Biowaste zone shall be demolished and rerouted to the new Biowaste collection tanks. This is required to provide the clearance for the new SSP EDS equipment and tanks and to be able to drain into the new Biowaste collection tanks. BSL-3E and BSL-4 waste piping shall be kept separate to common headers which connect to waste collection tanks. Biowaste piping coming from each suite must be separate from other suites and have cleanouts to allow for isolation of that suite using inflatable plugs. Re-use existing cleanout locations to minimize new penetrations. Once past the isolation cleanout the piping may combine with other suites. Avoid running Biowaste piping above mechanical and plumbing equipment.

Pipe materials: Below grade; double wall FRP with bonded joints and leak detection cable. Above grade: schedule 40 seamless type 316L stainless steel, ASTM A312, with butt welded joints. For the piping at the EDS tube skids duplex stainless steel (S32205) with butt welded joints shall be used.

Biowaste piping materials and fabrication procedures shall comply with specifications, plumbing code and ASME B31.3 welding requirements. Use of welding rings (backing rings/chill rings) for any welded pipe shall be prohibited. Depth of the traps is to be coordinated with the design of the EDS collection tanks and their associated HEPA vent filters. Biowaste piping shall have 100 % visual inspection and non-destructive testing (like ultrasonic) inspection of a minimum of 50% of welds. If any of those fail, then 100% of welds shall be inspected. Weld inspector must be AWS certified or equal certification subject to Government approval. New drain piping is to be sloped at a minimum of a 2% slope for piping 2" and less, and minimum 1% slope for 3" and larger. BSL-3E and BSL-4 waste piping shall be kept separate until the connection to common headers which connect to waste collection tanks. Valving shall be provided to allow draining of either BSL-3E or BSL-4 waste into any tank for maximum flexibility of use or isolation of tanks.

The vent HEPA assemblies shall be manufactured by the filter housing manufacturer or vendor experienced in providing assemblies for high containment and factory flow tested for performance. HEPA filter assemblies shall be fabricated of 316L stainless steel materials. HEPA filter assemblies shall allow for isolation and disinfecting of housings and elements in-place using either, liquid, steam or vapor disinfection methods. Arrangement shall allow for full interior surface contact and recirculation as well as drainage of the assemblies. HEPA filter assemblies shall require visual and non-destructive (x-ray or ultrasonic) inspection of all welds. Valves shall be 3-piece, full port cavity filled style. Drain/vent/decon valves shall be normally capped. Piping arrangement shall be per the referenced detail. Assemblies shall comply with BMBL 6<sup>th</sup> edition and current NIH Design Requirement Manual requirements. Assemblies shall be located in the accessible mechanical room level above the containment suites. HEPA filter assemblies shall have full accessibility and allow for access for decontamination and element replacement. Provide design of HEPA filter assemblies to allow for a possible steam vent tie-in. Weld inspector must be AWS certified or equal certification subject to Government approval.

#### D10 2.9 BIOWASTE EJECTOR SYSTEM (FOR SHOWERS):

A new ejector shall be provided to collect the biowaste from the showers and floor drains in the locker room area adjacent to the new EDS system. The waste shall be collected with a double walled underslab drainage

system to the receiver tank and be pumped using a duplex pair (N+1) of air operated double diaphragm pumps to lift the waste into the biowaste drainage system which empties into the new biowaste collection tanks. The ejector shall be in a concrete pit with FRP grated cover. Provide space and a ladder in the pit to allow for access for service and a low point sump for a portable pump if liquid is spilled. The pump piping and the receiver shall be provided with valved and capped decon ports and lowpoint receiver drain to decon in place the piping and receiver for maintenance. The receiver shall also have a vent combined with the biowaste vent from the drain piping for the showers that runs up to the roof.

The Biowaste liftstation shall be designed for a minimum runtime for a pump of 5 minutes and a maximum of 20 starts per hour shall be considered. Discharge pipe sizing must be a minimum of 3 fps to keep solids suspended and scour the piping.

Pipe materials: Schedule 40 316L stainless steel pipe, ASTM A312, with butt welded fittings.

#### D10 2.10 HIGH PRESSURE COMPRESSED AIR SYSTEM:

The project shall provide instrument quality air from the existing building system to the new EDS system equipment, the new water softeners and new mechanical equipment. There is sufficient extra capacity in the existing system.

New valved connections off the existing mains in the Biowaste Mechanical room area shall be provided.

Pipe material: Cleaned for oxygen service Type L copper, ASTM B819, with nitrogen purged brazed socket joints.

Pressure reducing valves with outlet pressure gauge shall be provided for each branch or piece of equipment to adjust the final delivery pressure as required by the supplied equipment. Two pressure reducing valves shall be installed in parallel for redundancy to avoid shutdown of equipment.

#### D10 3.1 SYSTEM TESTING AND BALANCING

Provide complete Testing and Balancing (TAB) of all water distribution systems and equipment, in accordance with plumbing or ASME code.

#### D10 3.2 PIPE LABELING AND VALVE TAGGING

Provide pipe labels and valve tags as per government requirements. Pipe labels are to be on outermost surface of pipe and include direction of flow. Valve tag numbering shall match valve numbers on P&IDs or drawings.

-End of Section-

CHAPTER 6  
D20 Fire Protection

**D20 FIRE PROTECTION****SYSTEM DESCRIPTION**

The Fire Protection section establishes and describes the relevant design scope and criteria for the Fire Sprinkler system modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. All Fire Protection systems installed meet the requirement of the codes, regulations and guidelines listed in Chapter 4 Applicable Criteria.

**D20 1.1 GENERAL****GENERAL DESCRIPTION**

The Fire Protection system in this area of this facility consist of the following:

1. Combined fire protection and potable water for the NIBC at Fort Detrick is provided from the water treatment plant (WTP) located on the bank of the Monocacy River. Treated water is pumped from the WTP approximately two miles to the NIBC water distribution piping network. Three (3) existing elevated water storage towers are part of the distribution network; these towers provide emergency water supply in case of a failure of the main water supply source at the WTP. One (1) of the towers can be filled from the City of Frederick water main crossing the NIBC. The water connection to the city water main includes a set of water pumps, backflow preventers and water meter. However, an agreement between the City of Frederick and the NIBC allows withdrawing water from the public source only in case of emergency. Fire water to the building is supplied by two (2) fire water service connections to the underground on-site fire water distribution main. Each of these services is connected to different parts of the building to provide redundant fire water supply to the facility. Both B8100 water services are sized for the maximum calculated flow of fire water, and provided with a post-indicating valve (PIV) prior to the building entry. Required fire water demand is based on the Unified Facility Criteria (UFC) 3-600-01 "Design: Fire Protection Engineering for Facilities" occupancy classification and associated sprinkler system hydraulic design density, design area, and type of sprinkler system. In addition to the required sprinkler water flow, an allowance of 500 gpm additional flow is included for hose streams sourced from the standpipe fire department connections. Due to the height of the existing Building 8100, the existing site water pressure (approximately 70 psig - static and 40 psig-residual), and the required pressure for the automatic fire protection system at the most hydraulically demanding zone, two (2) fire pumps provide the additional pressure needed. The B8100 fire pump house is located outside the new building both fire pumps are diesel engine-driven. The pump house is designed as a prefabricated stand-alone enclosure located on the site in vicinity of building 8100. This shall allow direct access by the Fort Detrick Fire Department to the fire pumps in the event of an emergency. The free-standing fire pump house is constructed in compliance with UFC 4-010-01 "DoD Minimum Antiterrorism Standards for Buildings." The fire pumps are supplied with a redundant feed from the site water distribution loop as described above. Two reduced pressure zone detector check assemblies installed in parallel are provided in suction sides of the fire pumps. No modifications are required for the firewater services.
2. Wet Sprinkler System: The existing B8100 sprinkler and standpipe system is supplied from the site. The building is fully sprinkled. The sprinkler systems are zoned by floors, smoke compartments and containment areas as approved by the Fire Marshal and Authority Having Jurisdiction (AHJ). These individual zones are supplied from standpipes located within the stair towers and provided with control valve assemblies consisting of

shut-off valves with tamper switches, check valves, flow switches and test/drain fittings. Valves controlling water flow to sprinklers are OS&Y type gate valves, or butterfly valves. Check valves are swing type, in-line wafer check valves are not used.

3. Standpipe System: The building is provided with a combined wet standpipe and sprinkler system. Automatic Class I standpipes with fire department hose valve connections are located at each enclosed exit stair tower. Fire department hose connections consist of a 2-1/2" Class I hose valve with cap. The pressure in the system is not expected to exceed 175 psig, as such, there is no need to provide pressure-reducing type hose valves. Redundant fire department inlet or Siamese type connections are provided. Siamese connections are provided with 4" Storz inlet connections. All the standpipes shall be interconnected at the lowest level. Two standpipes are interconnected at the third floor interstitial level above the BSL-4 area. The existing standpipes are located in the adjacent existing stairwells. There shall not be any modifications to the standpipe system.

## D20 1.2 GENERAL REQUIREMENTS

**Redundancy Concepts:** Because of the critical nature of this facility, a high level of systems reliability is required for safe and uninterrupted operation. For this reason, many systems are designed to include redundant equipment intended to maintain system operation to support this goal. This arrangement is termed "N+1", where N is the number of operating pieces of equipment to provide full system capacity. The "+1" refers to a spare unit that can be brought online when a system component is out of service for routine maintenance or is non-operational. The two fire pumps described above are an example.

**Operation Basis:** The EDS is a continuous process which requires the SSP to typically operate 24 hours a day, 7 days a week or when agent research activities are present in BSL-3E or 4 spaces

**Maintenance:** All systems and devices shall be designed to facilitate regular maintenance functions. Adequate service clearance to all equipment shall be provided to facilitate movement of personnel and equipment. Equipment shall be kept out of congested, difficult-to-reach locations and hazardous areas. Adequate clearance, as defined by manufacturer's min clearance requirements, shall be provided at all equipment to enable removal and replacement of equipment, without requiring prior disassembly of the equipment.

## D20 1.3 DESIGN CRITERIA

The design shall comply with NFPA 13 and UFC 3-600-01. The design shall include all required space, access, equipment, valves and devices to facilitate maintenance and testing requirements of NFPA 25 and UFC 3-601-02.

The existing Biowaste Zone Mechanical space is currently fully sprinkled as Ordinary Hazard Group 2 at a design density of 0.2 gpm/sq. ft. over 3,000 sq. ft. Existing upright rough brass sprinklers and piping shall remain and be modified where required for the new Steam Sterilization Plant (SSP) Effluent Decontamination System (EDS) equipment and program spaces. Connections to the existing systems shall be made within the Biowaste Zone Mechanical room using similar materials.

The new Toilet/Locker Room program areas with ceilings shall have new sprinklers designed as light hazard at a design density of 0.15 gpm/sq. ft. over 3,000 sq. ft. matching other similar areas of the building. New sprinklers shall be white concealed type matching other existing areas of Building 8100. New wet sprinklers shall be added to the existing wet sprinkler system in that area where new ceilings are being installed.

New sprinkler piping and fittings shall match existing and be schedule 40 black steel with threaded or roll grooved joints. Due to the existing system operating pressure the sprinkler branches are provided with additional bracing as required by NFPA 13, any new branch mains shall require similar bracing.

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Obtain or perform latest Firewater Flowtest information within 12 months of installation of work as basis of design for hydraulic calculations for new sprinkler modifications.

Provide hydraulic calculations for sprinkler modifications for new work.

Where new walls have been added, existing sprinklers may need to be relocated or additional sprinklers may be added to maintain proper NFPA 13 sprinkler coverage and spacing.

Additional sprinklers may be required to be installed by the new air handling unit, under new large ductwork or new groups of ducts or piping that obstruct existing sprinklers above them.

Pipe penetration details of rated walls and/or slabs are to be UL certified to match wall or floor rating.

Sprinklers installed at a height of 7'-0" or less shall be provided with wire guards.

### **D20 1.4 ANTI-TERRORISM / FORCE PROTECTION (AT/FP):**

AT/FP requirements must be considered in the design. Reference UFC 4-010-01.

### **D20 1.5 ACOUSTIC AND VIBRATION CRITERIA**

Acoustical and vibration treatment are provided, as required, to all system components, to maintain specified space noise criteria. All noise and vibration criteria is in accordance with general data indicated in UFC 3-450-01.

Seismic Criteria: All elements of the system shall be installed to withstand seismic forces as required by UFC 3-401-01 and criteria in Chapter 5 Paragraph 9.7.

### **D20 2.0 SYSTEM TESTING**

Provide complete Testing of all new sprinkler systems and equipment, in accordance with NFPA 13.

-End of Section-



CHAPTER 6  
D30 HVAC

**D30 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)****SYSTEM DESCRIPTION**

The HVAC Engineering, Instrumentation and Controls establishes and describes the relevant design scope and criteria for the HVAC Engineering modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. All HVAC systems installed meet the requirement of the codes, regulations and guidelines listed in Chapter 4 Applicable Criteria.

**D30 1.1 GENERAL****GENERAL DESCRIPTION**

The HVAC systems of this facility shall consist of the following:

1. **Steam and Condensate System:** The existing Central Utility Plant (CUP) provides steam at high pressure (100 to 125 PSIG) to serve the USAMRIID Building 8100 steam requirements. The Building 8100 is currently provided with two redundant steam services from the two Vaults locations (Vault #1 and Vault #2), off the site Utilidor distribution loop. A new high pressure steam service is to be connected to the existing 18" high pressure steam (S120) main header, for the thermal decontamination of the EDS process units, Filtration units, Storage Vessels and the space heating units for SSP, located in Mechanical Room 1SA202. The new high and medium pressure condensate is to be flashed to low-pressure and pumped to connect to the existing main Pumped Condensate line and return to the CUP.
2. **Chilled Water System:** The existing CUP provides chilled water at or below a maximum temperature of 42 degrees F to the Building 8100. The Building 8100 is currently provided with two redundant chilled water services from the two Vaults locations, off the site Utilidor distribution loop. The CUP refrigerant plant, primary pumping system and campus piping distribution are designed to operate with a minimum of 18 degrees chilled water temperature differential or 1.33 gpm/ton. Utilize the existing building chilled water pumping and piping distribution system to deliver chilled water to a new air handling unit (AHU) and fan coil units (FCUs) to serve the SSP spaces.
3. **Heating Water System:** Two new steam to water heat exchangers (HX) are to be utilized to generate heating water, arranged in N+1 arrangement. The design shall include two new hot water distribution pumps, one of which shall be redundant, to distribute heating hot water to the new AHU preheating coils, and reheat coils.
4. **Air Handling System:** The new air handling system shall be designed to deliver 100% conditioned outdoor air (OA), to ventilate air to the spaces and also provide directional air flow. The directional airflow system shall be designed to move air from the clean non-containment side to the containable spaces. The containable spaces (EDS Process, Filtration and Storage Vessels) shall be negatively pressurized. Filtration and Storage Vessels areas shall be the most negative pressure to adjacent spaces. Non-containable spaces shall be positively pressurized to push the air into the containable spaces that shall be exhausted via HEPA filtered units. One (1) 100% outdoor air AHU system shall be designed to serve the EDS Process, Filtration, Storage spaces and their associated non-containment spaces such as Control Display Room, and Ante Rooms. The air handling system shall consist of one (1) single zone, constant volume, low-velocity air system. The supply fan motors shall have VFD(s) for ease of balancing. Provide an OA intake louver and plenum at the west side of the building with the intake louver opening mounted a

minimum 10 feet above grade. Constant volume supply air terminal units with reheat coils shall be used to deliver conditioned and ventilated air to the Process spaces, Ante Rooms, Control Display, etc. and maintain the room temperature and pressure relationship directional airflow.

5. Exhaust HEPA filtered Housing and Fan System: Provide one new HEPA filter unit with two new exhaust fans, one shall be redundant (N+1). The exhaust fan motors shall have VFDs to compensate for filter pressure drop changes and ease of balancing. Constant volume exhaust air terminal boxes shall maintain the negative pressure relationship between the containable (process) spaces and the positively pressurized non-containable spaces by flow tracking.

#### D30 1.2 GENERAL REQUIREMENTS

Redundancy Concepts: Because of the critical nature of this facility, a high level of systems reliability is required for safe and uninterrupted operation. For this reason, many mechanical systems shall be designed to include redundant equipment intended to maintain system operation to support this goal. This arrangement is termed "N+1", where N is the number of operating pieces of equipment to provide full system capacity. The "+1" refers to a spare unit that can be brought online when a system component is out of service for routine maintenance or is non-operational.

HVAC Systems that shall have this N+1 redundancy approach include:

1. One (1) high-pressure steam (100 – 120 psig) service will provide steam to the SSP. A single, new 6" connection will be made at the existing 18" 120 psig steam line. The 120 psig steam service will be reduced as indicated to provide the required independent steam service pressures.
2. Two (2) steam pressure reduction stations, each station arranged in one 1/3, two 2/3 control valves and manual bypass around the control valves. One 2/3 control valve is for normal operation and the other 2/3 control valve is a redundant valve. The steam PRV's shall be in series in order to produce 70 psig steam from 120 psig source steam and 20 psig steam produced from the 70 psig steam.
3. Two (2) steam condensate receiver units with duplex pumps, each designed for full capacity
4. One (1) HEPA filter housing and two (2) exhaust fans, each designed for full capacity
5. Two (2) Heating hot water heat exchangers, each designed for full capacity
6. Two (2) Hot water pumps, each designed for full capacity

Operation Basis: The EDS is a continuous process which requires the SSP to typically operate 24 hours a day, 7 days a week or when agent research activities are present in BSL.3E or 4 spaces

Flexibility: The design of the supply, and exhaust air distribution systems shall include a 15% future capacity to provide flexibility requirements. This capacity shall be built into the air handling system, exhaust HEPA filters and fans, and the main headers of the distribution system. Individual terminal control boxes shall be sized for present load to allow for better control and system operation.

Maintenance: All mechanical systems and devices shall be designed to facilitate regular maintenance functions. Adequate service clearance to all equipment shall be provided to facilitate movement of personnel and equipment. Equipment shall be kept out of congested, difficult-to-reach locations and

hazardous areas. Adequate clearance, as defined by manufacturer's minimum clearance requirement, shall be provided at all equipment to enable removal and replacement of equipment, without requiring prior disassembly of the equipment. Provide all required fittings, connections and accessories required for a complete and functional system. Where possible mount control valve and accessories approximately 6 feet above finished floor in Mechanical Rooms, and in a manner as not to interfere with coil pull access and unit access. It is the requirement of the DB design team to plan, illustrate and review with USACE for approval of all maintenance access and processes, as well as show those envelopes in the final design. Layout of all components shall allow for access to maintain parts without the use of more than an eight foot ladder. Where the word "should" is used in manufacturer's instructions, substitute the word "must".

Piping connections to new equipment shall be provided with isolation valves and arranged so a minimal amount of piping is required to be removed for servicing of the equipment. Unions or flanges shall be provided at all new valves and inline devices to allow for service without requiring cutting of the piping. Coordination shall be required to maintain fully functional egress and service aisles. Where possible pipes shall be grouped together on common support channels maintaining a minimum of 2" between piping or inline components. Valves, control assemblies, steam traps and devices shall be accessible for maintenance and emergencies.

### D30 1.3 LOAD AND ANALYSIS CRITERIA

Weather data from Fort Detrick Design Criteria, Section 2.13B; UFC-3-410-01FA, UFC-4-510-01 (MIL-HDBK-1191); ASHRAE Fundamentals (v2005) Andrew AFB, MD; and UFC 3-400-02 Engineering Weather Data (EWD) for Baltimore-Washington, MD was analyzed by the Government and A-E design teams to establish the most stringent weather data to formulate the outdoor weather conditions used as a design basis for this project. This data was used in a manner described below to establish comfort cooling and critical area design criteria.

#### D30 1.3.1 OUTDOOR DESIGN CONDITION:

Base Process area cooling and heating loads on the maximum of the design values of 1% / 99.6% dry bulb (DB) and the corresponding mean coincident wet bulb (WB) temperature listed in the above documents.

1. Summer: 91°F DB/ 75°F WB
2. Winter: 12°F DB (5°F DB is used for preheat)/ 4 grains moisture

D30 1.3.2 Indoor Design Conditions: The design shall allow the space temperature and humidity for occupied spaces to be maintained within plus/minus 2°F and plus/minus 5% relative humidity (RH).

Summer (EDS Process spaces):	80°F DB/ 50% RH
Summer (Control Room):	75°F DB/ 50% RH
Winter (EDS Process spaces):	60°F DB minimum, 35% RH.
Winter (Control Room):	68°F DB minimum, 35% RH.

#### D30 1.3.2 INTERNAL HEAT LOADS

1. Lighting:  
Control Room: 1.5W/SF (Assumed. Actual lighting load shall be used)

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Process Areas (EDS, Filtration and Storage): 0.75W/SF (Assumed. Actual lighting load shall be used)

### 2. Equipment:

Control Room: 3W/SF (Assumed. Actual load shall be used)

Process Areas: Dependent on the specific manufacturer equipment.

Heat gain information for special equipment shall be obtained from the manufacturer or, where no information is available for ASHRAE Fundamental.

### 3. Occupant Heat Gain (people)

Control Room: 250 BTUH Sensible / 200 BTUH Latent

Process Areas: 275 BTUH Sensible / 275 BTUH Latent

#### D30 1.3.3 HOURS OF OPERATION:

EDS Process Spaces: 24 hours/day, 7 days/week.

#### D30 1.4 AIR SYSTEM DESIGN CRITERIA

##### D30 1.4.1 SYSTEM SELECTION

HVAC equipment serving EDS Process areas shall be selected with the capacity to maintain conditions 99.6% of the hours of an average year.

Equipment selections shall be in accordance with IECC and have Coefficients of Performance (CPO's) or Energy Efficiency Ratios (EER's) which are equal to or greater than the minimum values required by Code.

The following spare capacity shall be employed in the design calculations:

1. Cooling Capacity: 10%
2. Heating Capacity: 15%
3. AHU Supply/Exhaust: 15%
4. Air System Leakage: 5% of total.

##### D30 1.4.2 MINIMUM VENTILATION RATES (OUTSIDE AIR)

1. Minimum design outside air ventilation rates noted below are from ASHRAE Standard 62.1 – 2016 and are for occupied times only. These rates meet or exceed the current requirements of the International Mechanical Code (IMC) for mechanical ventilation.
2. Minimum Ventilation Rates in the Breathing Zone:
  - a. Office space: 5 cfm/person and 0.06 cfm/ft<sup>2</sup>
  - b. Storage Rooms: 0 cfm/person and 0.12 cfm/ft<sup>2</sup>

- c. Corridors: 0 cfm/person and 0.06 cfm/ft<sup>2</sup>
  - d. General Manufacturing 10 cfm/person and 0.18 cfm/ft<sup>2</sup>.
- 3. Exhaust Air Rates
  - a. Locker Room: 0.50 cfm/ft<sup>2</sup>
  - b. Toilets: 1.0 cfm/ft<sup>2</sup>
  - c. Janitor: 1.0 cfm/ft<sup>2</sup>
- 4. The actual ventilation rates supplied to each space shall match the most stringent requirement of the following criteria:
  - a. Cooling load requirements
  - b. Heating load requirements
  - c. Minimum ventilation requirements
  - d. Exhaust air make-up requirements

#### D30 1.4.4 AIR CHANGE / AIR MOTION CRITERIA

- 1. Base the minimum room air change (AC/Hr.) rates on the higher of the total airflow through each types of space or the sum of the flow required within the space.
- 2. Base the required (actual) air motion rates are based on the greatest of the following criteria:
  - a. Exhaust air requirement
  - b. Sensible cooling loads, required air changes per hour
  - c. Heating loads

#### D30 1.4.5 PRESSURIZATION CRITERIA

- 1. The air handling system and control shall be arranged to ensure that none of the EDS process spaces within the containable space shall ever have a positive pressure relationship with the adjacent non-containable spaces.
- 2. The process spaces with multiple layers of support spaces shall be designed to be progressively more negative relative to the surrounding areas. The HVAC system shall create a cascading directional airflow, which draws air from the “cleanest” areas towards more “contaminated” areas. Include visual monitoring devices at the Control Display Room and Ante Rooms or Vestibules to indicate and confirm directional airflow.
- 3. Passive control and/or flow tracking shall be provided for proper room air balance differentials using constant airflow terminal units. The process side of the building is considered a containable space and shall be most negative relative to the adjacent non-containable spaces.

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- Offset between supply and exhaust airflows shall be adjusted based on actual differential pressure. Differential pressure across doors as indicated by directional arrow shall be plus or minus 0.05 inches water column. Single doorways to have 150 cfm and double doorways to have 300 cfm as their airflow transfer values for initial balancing and Commissioning. Refer to Airflow Diagram M-600, Appendix F – Drawings and Diagrams for relative pressure differential relationship to adjacent spaces.

**D30 1.4.6 FILTRATION CRITERIA**

- Air serving production spaces shall be filtered with a double filter module consisting of MERV 8 and MERV 14 efficiency filters.
- All process exhaust shall pass through a single, 99.99% HEPA filtration via bag-in/bag-out filter housing with two exhaust fans in "N+1" arrangement.

**D30 1.4.7 AIR DISTRIBUTION CRITERIA**

- Ductwork – General:

Ductwork construction is based on SMACNA Duct Pressure Classifications or ACGIH Industrial Ventilation manual according to pressure class. For duct pressure classes between -10" w.g. and +10" w.g., utilize SMACNA HVAC Duct Construction Standards. Ductwork in excess of +/-10" w.g. shall utilize ACGIH Industrial Ventilation manual.

<b>SMACNA Pressure Classifications</b>			
<b>Pressure Class</b>	<b>Maximum Velocity</b>	<b>Operating Pressure</b>	<b>Sealing Required</b>
1" w.g.	2,500 fpm	Up to 1" w.g.	Transverse Joints, Longitudinal Seams and Duct Wall Penetrations
2" w.g.	2,500 fpm	Over 1" w.g. up to 2" w.g.	Transverse Joints, Longitudinal Seams and Duct Wall Penetrations
3" w.g.	4,000 fpm	Over 2" w.g. up to 3" w.g.	Transverse Joints, Longitudinal Seams and Duct Wall Penetrations
4" w.g.	4,000 fpm	Over 3" w.g.	Transverse Joints, Longitudinal Seams and Duct Wall Penetrations
6" w.g.	4,000 fpm	Over 4" w.g.	Transverse Joints, Longitudinal Seams and Duct Wall Penetrations
* Pressure ratings apply to positively and negatively pressurized ductwork.			

- Duct Pressure Classification:

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Supply ductwork system from air handling unit to the air terminal box shall be 6" positive.

Supply ductwork from the air terminal box to supply diffusers shall be 2" positive.

Exhaust ductwork from exhaust grille to exhaust terminal box shall be 2" negative (leak-tested).

Exhaust ductwork from exhaust terminal box to HEPA filter housing shall be 4" negative.

Exhaust ductwork from HEPA filter housing to exhaust fan shall be 6" negative.

3. Duct Friction Loss Sizing Criteria

Supply Air: Ductwork from air handling unit to terminal control device is sized based on 0.15" pressure drop per 100' equivalent of duct or a maximum velocity of 2,000 FPM. Air unit distribution duct downstream of terminal devices is sized based on 0.1" pressure drop per 100' equivalent of duct or a maximum of 1,800 FPM.

Exhaust Air: Ductwork from exhaust grills to exhaust terminal box is sized based on 0.1" pressure drop per 100' equivalent of duct. Duct from the control box to the exhaust fan is based on 0.15" pressure drop per 100' pf duct run, up to a maximum velocity of 2,000 FPM.

4. Material Definition: Where duct material is specified to be stainless steel, it is to be fully welded construction, type 304L stainless steel minimum. Welded ductwork shall be a minimum of 16 gage sheet metal. Where not mentioned or mentioned to be galvanized, duct meets G-90 galvanized weight specifications and is spiral wound round with welded joint fittings or rectangular duct with gasketed mechanical joints for transverse joints. The gasket material at mechanical joints shall be of a chemical resistant type such as norprene, neoprene, Viton or similar.

5. Duct Insulation: Insulation is provided for all air conditioning supply ducts with rigid board insulation exposed in Mechanical Equipment Rooms. Outside air ducts is provided with a minimum of 2" rigid board insulation.

**D30 1.4.8 AIR SYSTEM COMPONENT SIZING CRITERIA**

1. Louver Criteria

- a. Fresh air intake: 400 FPM maximum through free area
- b. Exhaust: 700 FPM through free area.

2. Damper velocities

- a. Fresh air intake: 1,000 FPM maximum

3. Coil Velocities

- a. Preheat coils: 600 FPM maximum
- b. Cooling coils: 425-450 FPM
- c. Reheat coils: 650-700 FPM.



- d. Maximum rows: 8
- e. Maximum fins: 12 per inch.

#### D30 1.4.9 Balancing and Duct Pressure

1. Air handling system shall be balanced for specified design flow rate  $\pm 5\%$ , and system static pressure.
2. Air balance reports shall be submitted for final review and approval.
3. Testing and balancing shall be performed by an independent contractor.
4. Testing:
  - a. Duct systems shall be pressure- and leak-tested in accordance with AABCo. An alternate method foldout testing includes SMACNA as modified by SMACNA Appendix C is acceptable. Acceptable leakage rates are as follows: Medium- and high-pressure ducts are to be leak-tested to a maximum allowable leakage of 2%. Low pressure which includes 2" negative to 2" positive ducts, are not to be leak tested.
  - b. Proprietary mechanical transverse joints such as Ductmate, TDC, TDF, and similar joints are to be sealed along each duct (connection) as specified. Experience with this criteria shows that a 4% leakage allowance is a realistic expectation of construction quality. These type of joints shall be only permitted in low pressure ductwork.
  - c. Welded duct systems leakage shall be less than 1%, or nominally measurable leakage. Duct pressure classifications are indicated on details on the final contract documents. Tests shall be to pressures indicated. Tests on suction side of fans shall be under negative pressure test.
  - d. HEPA filters are to be tested by an independent laboratory and certified after installation.
5. The balancing contractor shall determine the final required CFM airflow offset required to achieve the pressurization across doorways to adjacent spaces as indicated on drawing M-600. The final required offset shall become integral to the tracking control logic between supply and exhaust. The airflow offset value shall be taken during both heating and cooling seasons in order to determine worst case values due to seasonal variations and building stack effect experienced at the project area.

#### D30 1.5 ANTI-TERRORISM / FORCE PROTECTION (AT/FP):

AT/FP requirements, including equipment supports and shutdown controls, shall be considered in the design. Reference to UFC 4-010-01.

#### D30 1.6 ACOUSTIC AND VIBRATION CRITERIA

Acoustical and vibration treatment shall be provided, as required, to all system components, to maintain specified space noise criteria. All noise and vibration criteria shall be in accordance with general data

indicated in UFC 3-450-01. Provide minimum 4-inch thick concrete housekeeping pads and vibration isolators under all floor-mounted equipment with a minimum 6-inch clear.

Vibration isolators and flexible connections shall be provided for all rotating equipment such as pumps, fans, and similar motorized mechanical equipment. Vibration isolation hangers shall be provided within 50 feet of pumps.

Seismic Criteria: All elements of the mechanical system shall be installed to withstand seismic forces as required by UFC 3-401-01, Mechanical Engineering. Refer to Section 6 – A10 Structural Engineering, 2.2 Design Loads.

## D30 1.7 CRITERIA FOR STEAM AND HYDRONIC SYSTEMS

### D30 1.7.1 GENERAL SYSTEM CRITERIA

1. Pipe guides, anchors, expansion loops, supports, expansion joints, vents, drains, controls, and similar shall be provided where required for all piping systems to limit piping thermal deflection per run in compliance with piping codes and to be below a visually discernable deflection with final hanger/support location as assessed by the USACE QA representative for approval. Stresses shall not exceed 85% of ASME Code requirement. Provide an "as constructed" finite element stress analysis and report for USACE approval on steam systems or components greater than 15 psig. Thermal expansion, stress, anchoring, guides and piping support finite element stress and ASME B31.1 Code Analysis, in alignment with the fabricated and coordinate arrangement. The analysis and certificate of compliance shall be performed by a licensed Mechanical Engineer, with a demonstrated high level experience in finite element stress and code compliance analysis. The stress and compliance analysis must include and be in coordination with the final fabrication documents of the Seismic Restraint Analysis and the project Seismic Criteria. The criteria also apply to HVAC and building service piping as piping systems. The stress analysis shall be developed with specific attention to piping configurations and connections at the EDS equipment. Determine maximum allowable stresses at equipment per equipment manufacturer's information, and provide anchors, elbow swings, loops, etc. as required to eliminate undue stress at equipment as determined through the pipe stress model.
2. Gauges, thermometers, gauge cocks, thermo-wells, shut-off valves, control valves, and other devices shall be provided for each piece of equipment for operation, maintenance and balancing purposes.
3. All piping systems shall be cleaned and flushed prior to final testing and commissioning.
4. All piping system shall be tested per ASME and Codes, Standards and Guidelines in excess pressure and corrected for leakage. Do not insulate piping systems until all joints are tested to be leak-tight.
5. All hydronic systems shall be balanced for occupied mode peak required design flow rate and pump head. Balancing reports shall be provided and approved by USACE. Balancing shall be performed by an independent agency, approved by USACE.
6. Fan coil unit cooling coil condensate discharge locations to drain shall be coordinated with the Div 22 contractor to provide additional drains as required. Drains and condensate drain piping shall be located such to avoid tripping hazards or damage to piping. Fan coil units shall be provided with condensate pumps only where drainage cannot be accommodated without lift. Fan coil units shall be located and mounted for gravity

drainage such to avoid the need for condensate pumps wherever possible. All cooling condensate will be directed to normal sanitary waste.

7. Coordinate with Div 22 contractor for the locating of new floor drains required for normal operation of equipment or for servicing. Coordinate floor drain provisions for fan coil cooling condensate, air handling unit cooling condensate as well as service drains at pumps, heat exchangers, condensate return unit overflows and other major hydronic equipment.
8. Provide means of isolation through the use of shutoff valves for steam, steam condensate and hydronic system piping to facilitate maintenance of systems and equipment. Where packaged equipment is provided without local means of isolation, provide additional valving to the greatest advantage of potential maintenance activities such to prevent future system shutdowns or limit the functionality/use of unaffected equipment. Isolation capability shall be at the main, branch and equipment level at a minimum. Where system connections perform a safety function, i.e. venting or pressure relief, do not install any valves that may prevent safe operation.

#### D30 1.7.2 STEAM AND CONDENSATE SYSTEM:

1. Design shall be based on a 120 psig steam already routed into the Building 8100 from the Central Utility Plant (CUP). Steam is utilized for the thermal decontamination of the EDS process units, filtration unit, storage vessels and the space heating units. Provide a new steam pressure reducing station to reduce pressure to 70 psig for EDS process units. An additional PRV station shall reduce steam pressure to 20 psig for storage vessel decontamination and for space heating units such as AHU preheat, and reheat coils. Steam piping is considered critical to the operation of EDS system and as such all steam/condensate piping shall be provided with Seismic restraints as well as piping thermal expansion stress and code compliance analysis.
2. Steam Piping Sizing Criteria:  
Steam
  - a. Total Piping Pressure drop: 10% of operating pressure at source or pressure reducing station.
  - b. Maximum velocity (mech. Room): 12,000 fpm
  - c. Maximum velocity (outside mech. Room): 8,000 fpm.
3. Condensate system:
  - a. All pumped condensate is listed under water systems
  - b. Condensate return systems shall be sized at  $\frac{1}{4}$  psig pressure drop per 100 equivalent feet of pipe.
  - c. All piping shall have a minimum slope of 1/16" per linear foot of piping towards end of main steam trap.
  - d. Steam Trap sizing safety factor for warm-up loads is 2 to 1.

4. Piping Materials
  - a. Steam Piping: 1-1/2" and less shall be Schedule 80 welded black steel and larger shall be Schedule 40 welded steel or seamless black steel pipe with welded fittings.
  - b. Condensate: Schedule 80 seamless black steel pipe with welded fittings.
5. Chemical Treatment System
  - a. No chemical treatment shall be provided for steam systems since steam is not generated by the project.
6. Insulation:
  - a. Pipe insulation, non-flexible; fiberglass.
  - b. Material: Preformed commercial-grade fiberglass.
  - c. Insulation Thickness
    - i. For pipe sizes 1-1/2" and smaller: 1-1/2"
    - ii. For pipe sizes 2" and larger: 3".
  - d. Steam vent piping within building shall be insulated for safety reasons.
  - f. Aluminum jackets shall be on pipes exposed outside.
7. Welding Requirement: Refer to Specifications section 23 58 00.00, section 1.3 and paragraph 3.2.1.2 Welded joints for quality and installation criteria. Additionally refer to section 40 17 26.00 for welding procedures, qualification and testing procedures. The welding requirements shall be applicable to both shop and field welding work as part of the final installed systems. Use of welding rings (backing rings/chill rings) for any welded pipe shall be prohibited. All welding shall be installed in accordance to ASME B31.1 requirements and visually inspected by AWS certified inspectors. Randomly test 50% of welds using ultrasonic non-destructive examination (NDE) methods that are clearly documented by AWS certified inspectors that are further qualified in ultrasonic testing. 100% of these random welds shall pass or 100% of all welds shall be required to be NDE tested. The AWS certified inspector shall be a 3<sup>rd</sup> party inspector hired as a 1<sup>st</sup> tier sub to the general contractor.

#### D30 1.7.3 HYDRONIC SYSTEMS

1. The following sizing criteria apply to closed piping systems.
  - a. Chilled water / Hot water / Process water (<2");
    - i. Maximum pressure drop: 4 feet head per 100 equivalent feet of pipe.
    - ii. Maximum velocity: 8 feet per second.
  - b. Chilled water / Hot water / Process water (>2");

- i. Maximum pressure drop: 4 feet head per 100 equivalent feet of pipe.
- ii. Maximum velocity (mechanical room): 6 feet per second – 8" diameter, 12 feet per second - 8" and above.
- c. Pipe Material
  - i. 2" and smaller: Type L copper, soldered joints
  - ii. 2-1/2" and larger: schedule 40 steel pipe, welded or seamless black steel.
- d. Joints:
  - i. 2" and smaller: soldered joints, flanged or threaded only at equipment/components requiring regular servicing or replacement.
  - ii. 2-1/2" and larger: Butt-welded, flanged or threaded only at equipment components requiring regular servicing or replacement. Use of welding rings (backing rings/chill rings) for any welded pipe shall be prohibited.
- e. The Preheat and Reheat Hot Water Systems shall be provided with a Chemical Pot feeder.
- f. Condensate Drain Piping: ASTM B 88, Type L, hard drawn copper.
- g. Insulation: All insulation shall meet UFC, UFGS and references as listed in Codes, Standards and Guidelines.

Chilled water pipe insulation material shall be Polyisocyanurate, suitable for application requiring 25/50 flame/smoke rating. The insulation thickness shall be 1" thick for pipe sizes 3/4" and larger.

Hot water insulation material: Preformed commercial-grade fiberglass.

Insulation Thickness

  - i. For pipe sizes 1-1/2" and smaller: 1-1/2"
  - ii. For pipe sizes 2" and larger: 3".

Condensate Drain Insulation: Insulate condensate drain piping with flexible cellular insulation.

## D30 2.0 HVAC SYSTEMS

### D30 2.1 STEAM AND CONDENSATE SYSTEM SCOPE

New 6" S (120) pipe weldolet shall be connected to the existing 18" S(120) steam main located in Mechanical 1EA302B. New tie-in shall have double block and bleed configuration as such two new 6" OS&Y gate valves connected by a new 6" spool piece. Spool piece shall have 4" drip leg, trap assembly and 1-1/2" OS&Y hydro-test vent with plug. The tie-in of new 6" high pressure system to the existing high pressure steam main shall be coordinated and scheduled with the project phasing requirement to limit the permissible scope of the building steam outage and any mitigating steps necessary to continue providing

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heating, sterilization and electric service to the building during the interval. The existing 18" HPS service already has two redundant steam services coming into the building from the CUP at Vault #1 and #2. Refer to detail drawing Detail A1 on M-500 for the piping arrangement of double block and bleed valves.

The DB contractor shall prepare a sequence of work for review and implementation that shall address the following aspects at a minimum:

- Proposed tie-in point for all services requiring system shut down
- Step-by-step work sequence with anticipated time duration of each step
- Accommodations for any system cool-down periods
- Calendar date and total duration of outage required to facilitate work
- List of all materials and personnel required to be pre-ordered and on site to facilitate new work connections
- Method of assessing integrity of any new joints made, i.e. weld x-rays, prior to resumption of service
- Extent of piping insulation required to be removed in preparation of new work activities and provisions to temporarily remove and re-apply insulation to facilitate work prior to final repairing of all insulation
- Written approval of contracting officer for entirety of means and methods outlining work approach

The calculated winter peak steam load for Building 8100 is 146,000 lbs./hr. The estimated maximum peak simultaneous steam load for SSP EDS systems requires 7,700 lbs./hr. and maximum HVAC load is estimated at 1,100 lbs./hr. Therefore, the total peak steam loads for building 8100, including SSP steam load, is estimated at 156,600 lbs./hr. with 20% safety capacity added. Refer to Appendix H – Utility Load Calculations for the Building 8100 steam load and new steam load estimation calculation matrix.

The existing 18" HPS service has adequate spare capacity to handle the increased SSP steam load. The steam flow rate of 156,600 lbs. /hr. at 120psig would have steam velocity of 6,000 FPM which is within the recommended carrying steam velocity through 18" line.

Temporary boiler connections, with isolation valves, are already installed near Vault #1 or Vault #2, above the grade to accommodate the annual two (2) days CUP boiler plant shut down in the summer.

Connect the new 3" pumped condensate return (PC) piping weldolet to the existing 6" PC main located at Mechanical 1EA302 B. New tie-in shall have a gate valve for isolation.

New 6" HPS steam service for SSP shall have flow meter, separate from the 8100 building service. 3" pumped condensate from new Pumped Condensate Pumps (CRU-1 and 2) shall pump back to the existing 6" pumped condensate line in the Mechanical Room 1EA302B and then back to the CUP.

Two new pressure reducing stations (PRV-1 and PRV-2), to be located in mechanical space 1SA202. PRV-1 shall reduce 125 psig HPS to 70 psig for process EDS systems steam use, and PRV-2 shall reduce 70 psig to 20 psig to generate the building heating water system and to EDS Storage Tanks and Filtration units.

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Each PRV station shall be configured in the parallel arrangement with one 1/3 – two 2/3 control valves and manual bypass around the control valves. Each PRV station shall be completed with pressure gauges across the PRV and isolation valves for servicing the individual PRV and safety pressure relief cut-off valves. Steam safety pressure cut-off valves shall not require safety relief vents to the outside. (See specification Division 23 for final detailed and equipment specification). Refer to the schedule drawing M-701 for sizing and capacity and detail drawing Detail C2 on M-502 in Appendix F- Drawings and Diagrams. For guide specification, refer to specification section 23 58 00.00, for quality and performance criteria equal to as specified.

70 psig steam shall be distributed to EDS systems, and 20 psig steam Filtration units, pump skids and Storage Tanks for thermal decontamination.

Low pressure (20 psig) steam shall be fed to the process storage tanks and filtration units and pump skids for cleaning and shall also feed to shell & tube heat exchangers to generate hot water for preheat coils in air handling unit, and reheat coils in air terminal boxes.

Flash tank FT-2 shall -flash steam from high-pressure and flash tank FT-1 shall flash medium pressure steam condensate. The flash tanks calculations shall be required to show that backpressure shall not accumulate based on actual vent size and path to atmosphere with the warm-up flow for all incoming connections and a single trap failure of the largest trap on the project. Condensate outlet from the flash tanks shall be trapped and shall be lifted by an electric Condensate Receiver and Duplex Pumps (CRU-3) to a new central Condensate Receiver and Duplex Pumps (CRU-1 & 2). The condensate receiver and pump system (CRU-1 & 2) shall be arranged in the N+1 configuration. Refer to the schedule drawing M-701 for sizing and capacity. Provide condensate return units with a trapped overflow to drain. Provide the overflow with a temperature sensing bulb and automatic domestic cold water quenching kit to reduce effluent temperatures to 140F or less prior to discharge at the drain. For guide specification, refer to specification section 23 58 00, for quality and performance criteria equal to as specified. Refer to Detail B1 on detail drawing M-501.

Refer to steam and Condensate Flow Diagrams on MP-601 and MP-602 in Appendix F – Drawings and Diagrams.

### **D30 2.2 HEATING HOT WATER SYSTEM**

Provide two steam to water heat exchanger (HX-1 & 2) for the preheating, and reheat heating water system plus 15% safety / future. Each sized for 100% of the load, arranged in N+1 arrangement. The heat exchanger shall be Shell and Tube type with steam supply to generate hot water.

Two hot water distribution pumps, one is redundant, shall distribute heating hot water to AHU preheating coils, and reheat coils. Provide VFD on inverter ready pump motor. Pumps shall be end-suction, centrifugal pump type and furnish with the inlet suction fittings. Refer to the schedule drawing M-701 for sizing and capacity and detail drawing Detail C2 – End Suction Pump Detail on M-501 in Appendix F. For guide specification, refer to specification section 23 64 26 – Chilled, Chilled-Hot, Process and Condensate Water Piping System, paragraph 2.6.1.2 – End Suction Pump for quality and performance criteria equal to as specified.

Provide hot water system ancillary equipment such as bladder type expansion tanks, air separator, make-up water system and shot feeder type closed loop chemical water treatment. Refer to detail drawing Detail C1 on M-501 for the arrangements.

Heat exchangers shall have 1/3 and 2/3 capacity control valves on steam supply. AHU preheat coil shall have in-line freeze protection pump and 3 way control valve as shown on Detail B3/M-500. Reheat heating hot water control valve shall be of Pressure Independent Control Valve (PICV) type.

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Refer to the schedule drawing M-701 for sizing and capacity and detail drawing Detail A4 – Heat Exchanger Piping Detail A4 on M-501 in Appendix F. For guide specification, refer to specification section 23 57 10.00, for quality and performance criteria equal to as specified.

Refer to MP-600 in Appendix F for Heating Hot Water Flow Diagram.

### **D30 2.3 CHILLED WATER SYSTEM**

New 3" chilled water supply and return piping shall be connected to the existing chilled water supply and return mains located in Mechanical Room 1EA302B.

The chilled water is provided at 42 degrees F and shall be returned to the system at 60 degrees F.

The piping distribution system shall deliver chilled water to the AHU and FCUs throughout the space. AHU cooling coil shall be selected with desaturation reheat, using chilled water return to reheat for desaturation of leaving coil temperature for blow-thru coil selection. Control valves for chilled water coils in AHU and FCUs shall be Pressure Independent Control Valve (PICV) type. Refer to detail drawing Detail A4 on M-500 for AHU cooling coil piping arrangement.

Refer to MP-600 in Appendix F for Chilled Water Flow Diagram.

### **D30 2.4 AIR HANDLING SYSTEM**

The air handling system (AHU) shall deliver 100% OA, conditioned and ventilated air to the spaces and also provide directional air flow. No recirculation / return air shall be permitted. The AHU shall have energy heat recovery with Heat Pipe to recover energy from the exhaust air. The preheat and cooling coil sizing shall assume failure of the heat recovery systems.

The directional airflow system shall be designed to move air from the clean non-containment side to the containable spaces and Anti Rooms are provided between spaces to ensure proper directional airflows are maintained at the door cracks. All ductwork, piping, conduits and openings penetrating walls shall be sealed tight so that airflows are driven to directional airflow at the door. Containable spaces (EDS Process, Filtration and Storage Vessels) shall be negatively pressurized. Non-containable spaces shall be positively pressurized to push the air into the containable spaces that shall be exhausted via HEPA filtered units.

One (1) 100% outdoor air AHU system shall serve the EDS Process, Filtration, Storage spaces and their associated non-containment spaces such as Control Display Room, Toilet, Shower, and Ante Rooms.

The air handling system shall consist of one (1) single zone, constant volume air system with energy recovery. Refer to schedule on M-700 for the size, capacity and performance criteria. Refer to Detail B1/M-500 for AHU configuration.

The AHU shall operate 24 hours a day, 7 days week at reduced speed. AHU shall draw outside air from an outdoor air intake louver and plenum designed to prevent snow accumulation or carry-over. Louver shall be sized for maximum velocity of 400 FPM based on louver free area and 8 feet deep intake plenum shall be provided to prevent snow drift. The louvers shall be included in the architectural scope. The intake plenum shall be of double, insulated wall construction. The bottom of the plenum shall be sloped to the drain outlet and piped to nearest floor drain. Provide access door in the intake plenum. Provide adequate access to change filters, replace coils if necessary, service motors, drives, variable frequency drives, control valves and dampers. AHU shall not condense water on the outside or within non-contact assemblies of the units. Provide no-thru-metal, thermal break construction for casing walls; floors and roof for 100% outside air AHU.



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Air handling units shall be blow through, custom-manufactured double metal wall type with 2" foam construction with the following components:

1. Supply Air Tunnel (Side Section)
  - a. Inlet plenum / access section: Low-leakage intake damper, access door with double wall glass view panel, marine light fixture pilot light switch outside of door. Provide insulated outside air damper.
  - b. Filter Section: Face loaded MERV 8 pre-filter and MERV 14 final filter.
  - c. Access Section: Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.
  - d. Supply Fan / Access Section: Two Plenum type, centrifugal fans, direct drive mounted on inertia base (concrete install in field) on spring isolators. Two supply fans shall be provided for redundancy so that when one fan fails, AHU shall still provide a least 75% of peak design airflow. AMCA 210 certified fan with AMCA seals. Fan bearings must have a minimum average life of 200,000 hours at design operating conditions. Fan motor shall be inverter ready with variable frequency drive (VFD) and high efficiency motor. Access door large enough for motor removal and with double wall glass view panel. Also provide sealed a double gasket removal wall panel section for fan removal. Provide marine light fixtures with pilot light switches and GFI Power outlet with hinged metal cover plate, outside of door.
  - e. Heat Pipe Section: Energy recovery heat pipe coil, maximum 500 FPM. Low leakage bypass damper shall be provided at the supply tunnel for frost protection. Bypass damper shall remain closed until the outside temperature falls below 12 degrees F. Provide heat exchanger that does not require tilt control for defrost or summer recovery. Heat pipe shall be selected based on optimizing winter heat recovery. Drain pan constructed of welded type 300 series stainless steel shall be provided at both supply and exhaust tunnels.
  - f. Preheat Coil Section: Hot water piping to preheat coil shall have bypass pipe with freeze protection in-line pump for frost prevention.
  - g. Access Section: Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.
  - h. Cooling Coil Section: Chilled water cooling coil mounted in stainless steel holding frame; at approximately max. 450 ft/min. Cooling coil located in casing section with stainless steel liner, drain pan and access doors. Coil to be individually removable. Provide intermediate drain pan when multi-array coils are installed, with downspouts for upper coil.
  - i. Access Section: Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.
  - j. Discharge / Access Section: Combination isolation/smoke damper, stainless steel construction, mounted on discharge outlet from main unit casing, with damper actuators outside of airstream. Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.

2. Exhaust Air Tunnel (Side section-ERU)

- a. Inlet plenum / access section: Low-leakage isolation control damper, access door with double wall glass view panel and marine light fixture with pilot light switch outside of minimum 24" wide access door.
- b. Heat Pipe Section: Maximum 500 fpm.
- c. Access Section: Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.
- d. Exhaust discharge plenum / access section: Minimum 24" wide access door with double wall glass view panel and marine light fixture with pilot light switch outside of door.

Install unit on a housekeeping pad and or structural steel with sufficient height to allow for a trap in the discharge of the drain pan for condensate with whatever negative/positive pressure depending on draw thru or blow thru unit configuration.

OA intake louver and plenum shall be provided at the west side of the building with an intake louver opening mounted a minimum 10 feet above grade. The louver shall be included in the architectural scope.

Supply Air System Components: Constant air volume supply air terminal units with reheat coils deliver conditioned and ventilated air to the Process spaces, Ante Rooms, Control Display, etc. and maintain the room temperature and pressure relationship directional airflow. All supply air ductwork is galvanized and constructed to SMACNA standards.

The DB contractor shall develop the total static pressure required for the system to operate based upon full flow conditions (including any spare capacity), final equipment selections, fully loaded filter conditions, AHU internal static pressures of individual components and distribution losses of the as-proposed ductwork system (louver to room device) with minimum 15% static pressure safety factor. Static pressure lost to system effect at fans and other system elements shall be considered as part of these calculations. All fans shall be sized according to these calculated flow and pressure accommodations.

Refer to the schedule drawing M-700 for sizing, performance criteria and capacity; and Air Flow Diagram on M-600 in Appendix F – Drawings and Diagrams. For guide specification, refer to specification section 23 00 00 – Air Supply, Distribution, Ventilation and Exhaust System for quality and performance criteria equal to as specified. Refer to detail drawing Detail B1 on M-500 for AHU configuration.

**D30 2.5 EXHAUST HEPA FILTERED HOUSING AND FAN SYSTEM:**

One HEPA filter housing unit. Provide bypass duct around the HEPA filter housing, with motorized leakage tight damper, to allow bypass air around HEPA filter housing during decontamination of the HEPA units.

Two exhaust fans (EF-1 and EF-2), one of which is a redundant exhaust fan. The exhaust fans type shall be in-line, mixed flow, centrifugal, and hung with spring isolator hanger from structure above. AMCA 210 certified, with AMCA seal. Provide direct-drive type fan with VFD to compensate for filter pressure drop changes. Both fans are intended to operate at reduced speed during normal mode of operation. The DB contractor shall review the fan curve and operating characteristics of the equipment intended to be installed to confirm stability for the range of flows and static pressures during all modes of operation. If concurrent operation of both fans is not achievable due to the operating characteristics of the fan equipment, a sequence shall be developed to smoothly alternate between active/inactive fans while maintaining airflow. When one fan is out of service, the remaining fan shall operate at maximum speed. A bypass duct and damper shall be provided to bypass the exhaust tunnel of the AHU to allow for servicing of heat pipe.

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Exhaust fans shall discharge to outdoor through an exhaust discharge plenum and louver. The louver shall be included by the Architectural scope of work.

Exhaust Air System Components: Constant volume exhaust air terminal boxes shall maintain the negative pressure relationship between the containable (process) spaces and the positively pressurized non-containable spaces by flow tracking.

HEPA filter housing consists of the following:

1. Intake manual bubble tight damper
2. Inlet plenum with 3" decontamination port
3. Inlet test section with injection ports and swing away diffuser plate for diffusion of test aerosol
4. HEPA filters
5. Spore test Strip port
6. Transition plenum with 3" port for para formaldehyde or similar decontamination
7. Outlet pneumatic operated bubble-tight damper with a manual hand wheel override
8. Stainless steel frame capable of supporting all above components
9. All HEPA filter housing components are manufactured of type 316 stainless steel.

Exhaust ductwork from the room penetration point and HEPA assembly to be constructed of continuously welded (longitudinal and transverse joints), type 304 stainless steel. Min gage of ductwork to be welded in 16 ga to reduce likelihood of torch blow-through and pin-hole leaks.

Exhaust ductwork from the HEPA assembly to, and including, the exhaust header and exhaust fans is galvanized.

The DB contractor shall develop the total static pressure required for the system to operate based upon full flow conditions (including any spare capacity), final equipment selections, fully loaded filter conditions, AHU internal static pressures of individual components and distribution losses of the as-proposed ductwork system (louver to room device) with minimum 15% static pressure safety factor. Static pressure lost to system effect at fans and other system elements shall be considered as part of these calculations. All fans shall be sized according to these calculated flow and pressure accommodations.

Refer to the schedule drawing M-700 for sizing and capacity and Air Flow Diagram on M-600 in Appendix F – Drawings and Diagrams. For guide specification, refer to Specifications section 23 40 00 – Chemical, Biological, and Radiological Air Filtration System for quality and performance criteria equal to as specified.

Refer to detail drawing Details A2 and B2 on M-500 for HEPA Filter Unit arrangement.

### **D30 2.6 Fan Coil Units**

Provide cooling only piping to 2-pipe fan coil units located around EDS units, Filtration and Storage Vessel space, Mechanical area and at Electric room to maintain spaces temperature. FCU chilled water cooling coil control valves shall be PICV type. Auxiliary cooling coil drain pan shall be provided.

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D30 HVAC Engineering

Refer to the schedule drawing M-701 for sizing, performance criteria and capacity and detail drawing Detail C3/M-500 in Appendix F. For guide specification, refer to Specifications section 23 64 26 – Chilled, Chilled-Hot, Process and Condensate Water Piping System for quality and performance criteria equal to as specified.

### **D30 3.0 SYSTEM TESTING AND BALANCING**

Provide complete Testing and Balancing (TAB) of all air and water distribution systems and HVAC equipment, in accordance with United Facilities Guide Specification (UFGS) 23 05 93, Testing, Adjusting and Balancing for HVAC.

#### **D30 3.1 HVAC Systems**

Provide HVAC systems testing and balancing that complies with the requirements specified in UFG Specification Section 23 05 93, Testing, Adjusting and Balancing for HVAC.

### **D30 4.0 HVAC COMMISSIONING**

Refer to Specifications sections 01 91 00.15 and 26 08 00 for Building Commissioning requirement. HVAC system to be commissioned include HVAC systems, HVAC equipment, Controls and referenced systems.

-End of Section-

**CHAPTER 6**  
**D40 Controls**

## D40 INSTRUMENTATION AND CONTROLS

### SYSTEM DESCRIPTION

The Instrumentation and Controls establishes and describes the relevant design scope and criteria for the Instrumentation and Controls modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. All Instrumentation and Controls installed must meet the requirement of the codes, regulations and guidelines listed in Chapter 4 Applicable Criteria.

#### D40 1.1 DIRECT DIGITAL CONTROLS

Provide an ASHRAE Standard 135 compliant Direct Digital Control (DDC) system to comply with UFC-3-410-02 – Direct Digital Control for HVAC and other Building Control Systems. Provide integration of the new DDC systems to the existing building UMCS network, operator workstation and the operator workstation software, utilizing BACnet communication protocol.

The new DDC is to be designed and integrated into the existing system in accordance with UFC 4-010-06 Cybersecurity of Facility-Related Control Systems, USACE ECB 2018-11 Control System Cybersecurity Coordination Requirement, the Risk Management Framework (RMF), UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems, and UFGS 25 10 10 Utility Monitoring and Control System (UMCS) Front End and Integration.

The existing B8100 DDC system is manufactured and installed by Schneider Electric. The new DDC must have seamless integration and communications with the existing building system and be capable of sending to, receiving from, and interpreting global commands with the building system and resident software.

Anti-terrorism / Force Protection (AT/FP) requirements, including equipment supports and shutdown controls, shall be considered in the design. Reference to UFC 4-010-01.

#### D40 1.2 CYBER SECURITY

The existing Utility Monitoring and Control System (UMCS) shall not be altered and is subject to all of the existing cybersecurity requirements. The new equipment is considered to be an extension to the existing UMCS, with the point of demarcation being the connection between new network switch and the existing network. The cybersecurity C-I-A (Confidentiality - Integrity - Availability) level of the new equipment is Low-Low-Low (L-L-L).

The cybersecurity classification level of the new UPS system is Low-Low-Low (L-L-L). All UPS system signals are hardwired, digital or analog signals interfaced through the DDC system only.

Design, acquire and execute all devices and systems in accordance with DOD UFC 4-010-06 Cybersecurity of Facility-Related Control Systems, USACE ECB 2018-11 Control System Cybersecurity Coordination Requirement, the Risk Management Framework (RMF), UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems, and as required by individual Facilities Engineering Command (FEC) or Installation implementation policy.

#### D40 1.3 EFFLUENT DECONTAMINATION SYSTEM (EDS) CONTROL SYSTEM

Reference C10 for details on the Effluent Decontamination System

#### D40 1.4 DDC CONTROL CRITERIA

DDC systems serving to support the EDS areas shall operate 24 hours per day, 7 days per week.

DDC shall monitor new meters on the incoming building steam and condensate return, meters provided by Energy Systems Group (ESG). Set up trend reports to record data daily and store values in the general-purpose programmable controller (GPPC) for later retrieval by the existing UMCS via operator workstation DDC computer.

The DDC systems shall utilize the existing UMCS remote notification system. Remote notification shall be coordinated with Owner, including but not limited to the following: coordinate the content of the alarm messages, which alarms require messaging, which employees require the e-mails, and all technical aspects.

Provide patch panel in the mechanical equipment room for ease of connection and disconnection of equipment. Provide panels with keyed locks

Provide air handlers and all terminal units, including VAV boxes, with discharge/supply temperature sensors.

Provide control to automatically start back-up HVAC equipment if the primary device fails. Primary and back-up equipment starter/VFD circuits must be wired to prevent both pieces of equipment from operating at the same time. Provide alternating algorithms to rotate equipment for equal runtime.

Design requirements must be in accordance with all specification notes and provided details.

System must include standalone direct digital controllers (DDC) connected to the existing UMCS communication network and visible from the existing workstation computer with existing control software. Provide stand-alone control routines that operate without connection to the network during a loss of communication. Provide trending, scheduling and alarm tables (may be included with the sequence of operation). Provide reset routines (based on outdoor air temperature or zone demand) for hot water loop temperature setpoints and supply air static pressure control. Use alarming and trending services during performance testing or commissioning. Alarm every sequence routine when out-of-limits or control/response failure occurs. Display all graphic floor plans, equipment graphics, and sequence of operations graphic pages.

Power for DDC equipment shall match the power requirements of associated equipment it is controlling. All 120-volt wiring must comply with NFPA 70. All 24-volt wiring must comply with the IMC and terminal device manufacturer's recommendations.

Actuation of dampers and control valves associated with terminal equipment (i.e. VAV, CAV, FCU, etc.) devices is predominantly electronic. Control dampers and control valves associated with terminal equipment shall be Fail In Place type.

Actuation of dampers and control valves associated with major primary mechanical equipment are pneumatic and shall be provided with pilot positioners for modulating control, where applicable. Typically, chilled water and steam control valves shall be fail-safe in the closed position and hot water control valves shall be fail-safe in the open position. Damper fail-safe position shall be dictated by the application, design professional shall make determination based on industry guidelines and standards.

The existing Building 8100 compressed air system has additional capacity and shall be utilized for the new pneumatically controlled equipment installed as part of this project. A new high pressure PRV set for 80psi shall be added to the existing BLS.3E Instrument Air 125 psig distribution line on the 1st floor for use with new bubble tight and bladder dampers. The existing 20 psig supply air distribution lines shall be extended

to instrumentation as required. Refer to D10 for Plumbing details.

New field installed sensors, transmitters and miscellaneous devices shall match existing equipment to the extent possible. Refer to Appendix O for Existing Facility BMS Bill of Material. Where a specification does not exist for a device, contractor must follow UFGS Section 23 09 13 -- INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.

Provide training on the installed system. Demonstrate all operator workstation functions requiring BACnet services, i.e., navigating through the graphic displays, trending, alarming and monitoring of the new controls system from the existing operator workstation using only the existing application software and without the need to launch other applications or logon to other vendor applications.

#### D40 1.4.1 DDC SYSTEMS

Provide complete DDC system for the Steam Sterilization Plant to meet the functional requirements of the specification section 23 09 93 – SEQUENCES OF OPERATION FOR HVAC CONTROL.

The following is a list of typical systems the new DDC systems shall control and/or monitor:

1. Steam and Condensate Return System:

The steam pressure reducing valve stations are controlled by digital controls as part of the manufacturer's supplied equipment, with monitoring and supervisory control provided by the DDC. DDC shall provide integration to the PRV controller(s) for monitoring, at a minimum, of incoming pressure and temperature, leaving pressure and temperature, high pressure alarms and system fault. The Steam PRV shall be provided with 1/3 and 2/3 valves installed in a parallel configuration. The valves shall be modulated in series (i.e. 1/3 valve opens 1<sup>st</sup>, 2/3 valve opens after 1/3 valve is fully open)

DDC shall provide monitoring of incoming steam serving the Steam Sterilization Plant. DDC shall monitor steam pressure, steam temperature, totalized flow and instantaneous flow.

DDC shall provide monitoring of condensate receivers and duplex pumps for individual pump status, receiver high level alarm, system fault, instantaneous condensate flow and totalized condensate flow.

Condensate shall be tempered to a maximum discharge temperature of 140 Deg F before it is discharged to drain.

2. Heating Hot Water System:

DDC shall provide control and monitoring of steam to hot water heat exchangers, pumps, heating water supply temperature, heating water distribution pressure and heating hot water flow. Control functions include modulation of steam heat exchanger control valves, minimum flow bypass control valve, heating hot water pump speed and cycling of heat exchanger hot water isolation valves. DDC shall monitor return water temperature.

3. Chilled Water Systems:

Chilled water distribution system is existing within Building 8100 and shall be extended to serve the chilled water requirements of this project; no additional controls shall be provided as part of this project. DDC shall monitor chilled water supply and return temperatures at the branch lines entering and leaving the SSP.



4. Energy Recovery Air Handling System:

DDC shall provide control and monitoring of supply air temperature, supply air humidity, space humidity in critical areas, supply duct pressure and supply airflow. Control functions shall include modulation of chilled and heating water coil control valves, humidifier steam control and isolation valves and supply fan speed. DDC shall provide control functions for heat pipe bypass damper. DDC shall monitor outdoor air temperature, outside air humidity, temperatures up-stream and down-stream of any energy exchange or input device, pressure drop across filters and required equipment safeties.

Refer to 'HEPA Filter Housing Exhaust System for Exhaust air tunnel control.

5. HEPA Filter Housing Exhaust System:

DDC shall provide control and monitoring of exhaust air temperature, exhaust air humidity, exhaust duct pressure and exhaust airflow. Control functions shall include modulation of exhaust fan speed. DDC shall monitor outdoor air temperature, outside air humidity, temperatures up-stream and down-stream of any energy exchange or input device, pressure drop across filters, pressure drop across exhaust side heat recovery wheel and required equipment safeties.

DDC shall operate both exhaust fans simultaneously at reduced capacity. During failure scenario or maintenance shutdown, exhaust fan remaining in operation shall ramp speed up to maintain duct static pressure requirements allowing for minimal disruption to airflow while maintaining pressure boundary within the SSP. DDC shall control start/stop, speed of exhaust fans, open and closure of tight close off isolation dampers. DDC shall monitor damper open and closed positions.

*NOTE: Both fans are intended to operate at reduced speed during normal mode of operation. If concurrent operation of both fans is not achievable due to the operating characteristics of the fan equipment, a sequence shall be developed to smoothly alternate between active/inactive fans while maintaining airflow.*

DDC shall provide manual changeover to Heat recovery bypass duct to allow for decontamination of Heat Recovery Unit. DDC shall transition to heat recovery bypass duct with minimal disruption to airflow while maintaining pressure boundary within the SSP. DDC shall control start/stop, speed of exhaust fans and open and closure of tight close off isolation dampers. DDC shall monitor damper open and closed positions.

DDC shall provide manual changeover to HEPA bypass duct to allow for decontamination of HEPA filtration unit. DDC shall transition to HEPA bypass duct with minimal disruption to airflow while maintaining pressure boundary within the SSP. DDC shall control start/stop, speed of exhaust fans, open and closure of Bubble tight isolation dampers. DDC shall monitor bubble tight damper open and closed positions.

6. Airflow and Space Pressurization Controls:

DDC shall provide control and monitoring of space temperature, space pressure, supply airflow and exhaust airflow. Control functions include passive pressurization control by airflow volume tracking, active pressurization control by airflow volume offset reset and modulation of heating water coil control valves. DDC shall monitor discharge temperature downstream of heating water coil, airflow offset between exhaust and supply airflows, and differential pressure between space and adjacent corridor.

Supply airflow shall track exhaust airflow for negatively pressurized spaces. Exhaust airflow shall track supply airflow for positively pressurized spaces.

7. Fan Coil Units (FCU):

DDC shall provide control and monitoring of space temperature. Control functions include modulation of chilled water control valves and fan cycling. DDC shall monitor discharge temperature downstream of chilled water coils and moisture sensors located in auxiliary drain pans.

For FCU providing supplemental cooling to SSP areas in conjunction with air terminal units, DDC shall operate FCU in concert with air terminal units controlling both with the same temperature control loops to avoid simultaneous heating and cooling.

8. Air Terminal Units:

DDC shall provide control and monitoring of space temperature and supply airflow. Control functions include modulation of supply air damper and heating water coil control valves. DDC shall monitor discharge temperature downstream of heating water coil.

9. Leak Detection Monitoring:

DDC shall provide leak detection monitoring in the EDS Process Room, Filtration Room, Tank Storage Room, Mechanical and Plumbing Spaces.

DDC shall provide a distance read leak detection system comprised of conductive fluid sensing cable and spot leak detectors. System shall be installed to monitor leak conditions around and under EDS equipment, HVAC equipment, Plumbing Equipment and other points of interest.

Leak Detection System shall provide local display, indicating location of leak.

Locations of leak detection and equipment to be monitored with type of leak detection (i.e. distance read or spot detectors) to be coordinated between BMS Design Professional, EDS Design Professional and Owner.

DDC shall monitor the leak detection system via industry standard communication protocols.

Leak detection system shall be interlocked with EDS equipment to provide hardwired shutdown of equipment as required in the event of a leak condition in EDS associated spaces or around EDS equipment. EDS equipment shall not be shut down if leak occurs in mechanical or plumbing spaces where hazardous effluent is not expected.

10. Misc. Plumbing Systems:

DDC shall monitor new Water Softener Skid general alarms, via hardwired dry (voltage free) contacts.

DDC shall monitor new wastewater lift station general and high-level alarms, via hardwired dry (voltage free) contacts.

DDC shall monitor plumbing HEPA filters. The HEPA filter and differential pressure switch

shall be provided by Division 22. Design professional shall coordinate with Divisions 22 and 26 to determine locations and power requirements.

Refer to Section D10 for plumbing details.

11. Misc. Electrical Systems:

DDC shall monitor new centralized UPS equipment for low battery and general alarms, via hardwired dry (voltage free) contacts.

All system onboard displays that provide access to the comprehensive range of adjustable parameters necessary to perform installation, adjusting, service, maintenance, and testing must provide fully compliant password protection. All external ports, USB, RS 232/485/422, that allows connection to an on-site portable laptop computer must provide the same level of fully compliant password protected access as an on-board diagnostic panel

All Ethernet ports are to be disabled in firmware.

All systems must comply with UFC 4-010-06 Cybersecurity of Facility-Related Control Systems and UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems.

Refer to Section D50 for electrical details.

**D40 1.4.2 DDC INTEGRATION WITH 3<sup>RD</sup> PARTY EQUIPMENT**

Integration with 3rd party equipment shall occur through an open communication protocol or gateway, preferred communication shall be BACnet/IP or BACnet MS/TP. Other acceptable communication protocols include Modbus and Lonworks. Installer shall provide all required hardware for protocol translation. DDC shall provide graphic screens for system operator use on the existing operator workstations and shall depict the equipment and all software points available for control and monitoring by the DDC.

The following 3rd party equipment shall be integrated into the DDC:

1. All fan and Pump VFDs.
2. AHU Energy Recovery Wheel.
3. Steam PRV Controllers.
4. Leak Detection System.

All system onboard displays that provide access to the comprehensive range of adjustable parameters necessary to perform installation, adjusting, service, maintenance, and testing must provide fully compliant password protection. All external ports, USB, RS 232/485/422, that allows connection to an on-site portable laptop computer must provide the same level of fully compliant password protected access as an on-board diagnostic panel

All systems must comply with UFC 4-010-06 Cybersecurity of Facility-Related Control Systems and UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems.

**D40 1.4.3 DDC EQUIPMENT INTERLOCKING**

Failure response interlocking of the HVAC and mechanical equipment is accomplished through three

methods.

The first method is through the use of hardwire interlocks, which is a method by which control equipment is interlocked directly through relay logic and not reliant on any software control logic residing in any DDC controllers. The use of hardwire interlocks is implemented in applications where equipment needs to operate in concert and failure to do so could result in damage to equipment or create a potentially unsafe condition for the occupants.

The second method is software interlocks; which is a method by which control equipment is interlocked through the use of software control logic which resides in a single DDC controller. The use of software interlocks is primarily implemented in maintenance applications where equipment shall operate in concert and where failure of the DDC controller to execute the correct control logic shall not result in major damage to equipment or create any unsafe conditions.

The third method is interlocking equipment utilizing the DDC communication network to execute software control logic between DDC controllers. The use of these types of interlocks is implemented in energy efficient control strategies and building wide equipment restart routines where failure of a DDC controller or failure of the communication network shall only result in an inconvenience to the operators.

#### D40 1.4.4 EQUIPMENT RESTART PRIORITIZATION

Following a return to normal after a power failure or emergency shutdown condition, the new DDC equipment shall be added to the existing Building restart prioritization sequence. Priority to be coordinated between Design Professional and Owner.

-End of Section-

## CHAPTER 6

D50 Electrical, Lighting, Fire Alarm, and Information Technology

## D50 SYSTEMS OVERVIEW

This section describes the relevant design scope and criteria for the Electrical Engineering, Lighting, Fire Alarm mass notification and information technology system modifications associated with the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland.

### D50 1.1 DESIGN CRITERIA

Reliable electrical power is required for equipment associated with the sterilization process equipment and for mechanical equipment.

### D50 1.2 REDUNDANCY CONCEPTS

Much of the process and mechanical equipment shall be provided as N+1 redundant. Two separate feeders and panels shall be provided. Redundant equipment shall be divided among the two panels. Non-redundant equipment identified as essential shall be supplied from a panel connectible to either feeder through an automatic transfer switch.

### D50 1.3 ELECTRICAL POWER

1. Electrical power shall be derived from the existing Building 8100 electrical distribution system. Power to Building 8100 originates from the central utility plant. Through redundancies, rotary UPS equipment and standby diesel generations, a high level of reliability is provided.
2. Eight (8) underground feeders deliver power to Building 8100 at 12.47kV. There are four double-ended unit substations located throughout the building. Each double-ended substation is comprised of primary selector switches, cast coil dry type transformers, and main-tie-main secondary distribution. Each transformer can be connected to one of two feeders. In the event of loss of one transformer, auto switching circuitry shall disconnect the secondary distribution section and reconnect to the remaining energized transformer. Should power be lost at one of the secondary mains, an auto transfer mechanism shall open the main and close the tie circuit breaker.
3. Electrical power for the SSP shall originate from existing substation SS-4A / SS-4B. Two 400A feeders shall be run from spare circuit breakers. Each circuit breaker shall be connected to a separate bus. Each circuit breaker shall supply a dedicated feeder and panel. Each redundant (N+1) piece of equipment (process or mechanical) shall be fed from one of the new panels. Loss of a single feeder and panel combination shall not interrupt power to critical (N+1) equipment.
4. Conceptual loads indicate the need for 400A feeders and panels. Each 400A panel shall also feed a 30kVA transformer and 100A panel for miscellaneous loads.
5. Redundant solid state UPS units shall be provided for process and BMS PLCs and other loads intolerant of a power interruption.
6. Additional convenience receptacles shall be placed where needed. Receptacle cover plates shall be identified with panel name and circuit number.

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7. All wiring shall be copper with THHN insulation. Wiring shall be installed in rigid galvanized steel conduit. EMT may be used for feeders from the existing substation and within the new electrical room. Liquid-tight flexible metallic conduit shall be used for final connections where vibration is an issue.
8. Panelboards shall be comprised of NEMA 1 enclosure, door-in-door construction, copper bus and bolt-on circuit breakers. All circuit breakers shall be rated greater than the available fault current. Series rated circuit breakers shall not be acceptable.
9. Dry type transformers shall be copper winding, 115 degrees C temperature rise in NEMA 1 enclosures.
10. Provide labels for all receptacles and equipment. Receptacle labels shall include panel and circuit numbers.
11. Bed All conduit penetrations through Filter Room ISA2020.2T, Tank Storage Room ISA202.1 and the EDS Room separation walls shall be outfitted with sealing fittings to prevent air flow through the interior of the conduit system. Recessed boxes shall be cast type caulked around the perimeter to prevent air leakage.

### D50 1.4 LIGHTING

1. Existing lighting is comprised of 2 lamp 1' x 4' chain hung industrial fluorescent fixtures. Currently these fixtures are arranged in a grid pattern. These fixtures shall be removed and replaced with new fixtures.
2. All new lighting fixtures shall be LED type with neutral color temperature of 3500° and minimum 82 CRI. LED equipment shall comply with Illumination Engineering Society (IES) standards LM79 and LM80. Power supplies shall be electronic and designed for use with the LED source and luminaire.
3. Illumination levels shall be in accordance with IESNA recommendations. Average values are calculated at a horizontal plane on the floor. A light-loss factor of between 0.70 and 0.85 shall be used in the calculations to account for degrading of light over time. Calculation shall be based on point method.

ROOM / AREA	ILLUMINATION LEVEL (FC)
EDS Rooms	40
Tank Storage	40
Filter Rooms	40
Mechanical	20
Electrical	30

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ROOM / AREA	ILLUMINATION LEVEL (FC)
Control Rm	50
Locker	30
Circulation	20

4. EDS, Tank Storage and Filter rooms shall be provided with enclosed industrial type fixtures rated IP65. Lights shall be controlled with timed switches.
5. Mechanical and electrical rooms shall be provided with industrial type fixtures and controlled with timed switches.
6. Control Room, lockers and circulation shall be illuminated with recessed troffers and controlled with occupancy sensors.

**D50 1.5 FIRE ALARM/MASS NOTIFICATION**

1. Building 8100 has an FA/MNS system manufactured by SimplexGrinnell, now Johnson Controls. The FA/MNS provides fire alarm and mass notification throughout Building 8100 with the exception of a large portion of Mechanical Room 1SA202.
2. Early in the Building 8100 design phase, 1SA202 was intended to be unoccupied space with restricted access only for the inspection of BSL4 drain piping. Hence, minimal alarm initiating devices and audible and visual notification appliances were initially provided for 1SA202. This included a manual pull station and one audible/visual notification appliance at each exit vestibule from 1SA202.
3. As the design of Building 8100 evolved, plumbing equipment was later added along the wall at the southern end of 1SA202. To provide alarm and mass notification for maintenance personnel tending the added equipment, notification appliances were added to the local area providing coverage that was consistent with the design of other mechanical equipment spaces in Building 8100.
4. The insertion of the SSP into the previously unoccupied space of 1SA202 shall require the addition or relocation of FA/MNS initiating devices and notification in order to maintain compliance with UFC and NFPA standards. These additions shall include:
  - a. A manual fire alarm pull station at the new exterior exit from 1SA202.
  - b. The manual fire alarm station in Vestibule 1SA204 may have to be relocated to accommodate reconfiguration of the vestibule.
  - c. Additional manual fire alarm stations may have to be provided at new vestibules after study of travel distances to the nearest stations.

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- d. A duct mounted smoke detector associated with the new air handling unit supporting the SSP.
- e. A number of additional audible and visual alarm notification appliances shall be needed throughout the SSP to cover equipment spaces, rooms, and corridors.
5. The addressable device signaling line circuit needed to support the added pull station and smoke detectors already exists within 1SA202 and shall have adequate capacity.
6. The added audible and visual alarm notification appliances shall require additional notification appliance circuits, amplifiers, power supplies, and possibly a new FA/MNS enclosure. The most likely location for this added equipment is near to the existing FA/MNS enclosures within Vestibule 1SA201 at the southwest corner of 1SA202. Though the FA/MNS equipment location in Work Room 1NA102 to the north of 1SA202 is closer to the SSP, there are significant space restrictions that would have to be overcome in that location.

#### D50 1.6 INFORMATION TECHNOLOGY

1. Telecommunications: Building 8100 has a wired telecommunications structure administered by USAMRIID. Telecommunications outlets and wireless access points are supported from rooms designated Teledata1. The horizontal cabling in Building 8100 was standardized on the TIA Category 6 standard. Provide telephone/data outlets in locations listed in room data cards. Additional fiber optic backbone cabling is not anticipated to be needed and direction for providing new telecommunications outlets in the SSP shall be developed during the concept design phase of this project. The spaces occupied by the SSP and supporting equipment can be reached from Teledata1 1NA111 to the north and Teledata1 1SA810 to the south, whichever requires the shorter cable length.
2. Distributed Antenna System (DAS): Building 8100 has a combination DAS to provide reception for personal cell phones and reliable communications for Ft. Detrick emergency responders on different frequency bands. The initial installation included coverage of Mechanical Room 1SA202 as an open space. The layout of existing DAS components shall be re-evaluated as a result of the construction of new walls and the existence of new equipment within 1SA202 as part of the SSP.

-End of Section-

CHAPTER 6  
D60 Security

## D60 ELECTRONIC SECURITY SYSTEMS

The Electronic Security Systems (ESS) section describes the design scope and criteria for modifications associated with Access Control System, Video Surveillance System, Emergency Two Way Communication System, Intrusion Detection System and Duress Alarm System, for the Steam Sterilization Plant (SSP) Replacement Project in the existing U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) Building 8100 at Fort Detrick, Maryland. All systems installed shall meet the requirement of the codes, regulations and guidelines listed in Chapter 4 Applicable Criteria.

### D60 1.1 GENERAL SCOPE OF WORK

1. ESS subcontractor shall provide all necessary system design, integration, programming, configuration, material and labor required to expand the existing ESS currently in use at building 8100. Provide a turnkey installation including design and construction services to be an extension of an existing ESS which shall include addition of new video surveillance cameras, video display terminal workstation, relocation of card readers and balanced magnetic switches, automatic door operators, security telephone stations, illuminated in-use signage. ESS subcontractor shall design new components, wiring and devices of ESS, interfaces to existing ESS materials, labor, supervision, equipment, and expertise required to complete the base scope of the project per the contract documents and description herein.
2. ESS subcontractor shall provide product data and shop drawing Submittals for all software and installed components for A/E and Government review and approval following the Notice to Proceed. ESS subcontractor is required to meet material specifications per the contract documents.
3. ESS subcontractor shall utilize existing security equipment, access control panels, and other devices supporting the ESS located in security equipment rooms. Network hardware and devices shall be installed in existing equipment racks in security equipment rooms dedicated to security. Wall mounted devices are not acceptable. Security controllers and network hardware are not permitted in rooms other than security equipment rooms.

### D60 1.2 PROCUREMENT LOGISTICAL RESPONSIBILITIES

1. Electronic Security System (ESS) shall be procured by the Government from Design/Build contractor. ESS subcontractor shall be a single qualified firm primarily engaged in furnishing, fabricating and installing security systems, equipment and devices as specified, approved by the Government and certified by the manufacturer of existing security system. ESS Subcontractor shall provide copies of system manufacturer certification for all technicians.
2. ESS Subcontractor shall have a local service facility. ESS Subcontractor shall only utilize factory-trained technicians to install, program, and service devices and equipment of the ESS. Technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems.
3. ESS subcontractor personnel assigned to this project, in any role, must be United States Citizens, foreign nationals shall not be permitted. Personnel must have undergone documented pre-employment background investigations with criminal history check and shall be subjected to Q1 security investigation.

4. USAMRIID security ID/credentials shall not be issued to ESS Subcontractor. Access to security equipment rooms and communication center, when required, shall be by escort only.
5. Electrical (Division 26) Subcontractor shall furnish and install the electrical power supply panels, conductors, conduit, raceway systems, and terminations for the supply of new, dedicated 120 VAC power circuits to security system components. For new circuits to devices and equipment located in security equipment rooms, utilize spare 20A/1P circuit breakers in existing UPS power distribution units located in security equipment rooms.
6. Door Subcontractor is responsible for the pre-installation of door operators, electromagnetic locks, electric locks, electric strikes, low voltage power supplies for electric latch retraction hardware and similar electronic or electrical locking assemblies, to be wired and connected by ESS Subcontractor. Those items that are supplied by the Door Subcontractor but not physically connected to doors such as power boosters or automatic door actuators shall be installed by the ESS Subcontractor.

#### D60 1.3 EXISTING CONDITIONS

1. Existing ESS is based on ANDOVER CONTINUUM by Schneider Electric Critical Systems and HID iCLASS contactless smart card readers.
2. Existing Security Network is based on JUNIPER EX4600 Series Core Switch and Juniper EX200 Series Ethernet Switches, Stratus everRUN Enterprise Software, new switches require redundant fiber connections, one to each core switch as shown.
3. Existing video surveillance and recording system is based on PELCO Networked IP cameras utilizing PELCO's Spectra High-Definition Dome PTZ Cameras, PELCO VideoXpert scalable video management and surveillance system, PELCO E1-VXS-96-US network storage, E1-OPS-WKS6-US workstations and related products.
4. Existing Security Telephone System (STS) is based on TALK-A-PHONE MODEL ETP-400 connected to a TALK-A-PHONE PBX 64 head end. Existing STS PBX is a standalone system that serves only Bldg. 8100 and is not connected to telephone lines or systems outside Bldg. 8100.
5. "As-built" shop drawings and A/E design drawings are available in Appendix N. ESS subcontractor shall inspect the Work areas and prepare and submit a report of "Current Site Conditions" to the Government documenting site conditions that significantly differ from the design drawings or conditions that affect performance of the system to be installed. The ESS subcontractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions. The ESS subcontractor shall not correct any deficiency without written permission from the Government.

#### D60 1.4 PERFORMANCE VERIFICATION TESTING

1. Completed ESS shall be performance verification tested (PVT) independent of commissioning. PVT shall be performed in several stages in accordance with Section 28 20 01.00 10. See specifications for complete information on responsibilities of ESS contractor in regards to developing, scheduling, performing and documenting all phases of PVT. Follow example test procedures in Section 28 20 01.00 10a and 28 20 01.00 10b.
2. ESS Subcontractor shall prepare test procedures and reports for the PVT and the

endurance test procedure for all devices, equipment and systems specified and required. The ESS Subcontractor shall deliver the PVT procedures and endurance test procedures to the Government for approval prior to commencing or scheduling PVT.

3. Security Subcontractor shall provide technician services during commissioning procedures of other trades that involve components or functions of the ESS.
4. Testing shall not impact the operations of the rest of the ESS.

#### D60 1.5 CYBER SECURITY

1. The existing Electronic Security System (ESS) network security profile shall not be altered. The existing security network is dedicated to physical access control, alarm and video surveillance systems only and isolated from other systems and external connections. The preliminary cybersecurity C-I-A (Confidentiality - Integrity - Availability) level of the new equipment is Moderate-Moderate-Moderate (M-M-M).
2. Design, acquire and execute all devices and systems in accordance with DOD UFC 4-010-06 Cybersecurity of Facility-Related Control Systems, USACE ECB 2018-11 Control System Cybersecurity Coordination Requirement, the Risk Management Framework (RMF), UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems, and as required by individual Facilities Engineering Command (FEC) or Installation implementation policy.

#### D60 1.6 ACCESS CONTROL SYSTEM

1. Existing vestibules currently serving as the only normal entry and exit points to the EDS area shall remain. Existing card access readers with integrated keypads at each entry point shall remain except as noted otherwise and described as follows:
2. Ante Room 1SA202.9:
  - a. The vestibule oriented towards the Southwest of the facility shall remain as a normal entry and exit point. This vestibule shall be modified to serve carts traveling to/from loading dock and waste disposal areas. All work necessary to accommodate cart traffic shall be included in this project including but not limited to:
  - b. Provide two sets of double automatic door operators, manual and automatic controls for both sets of double doors, motion sensors, safety sensors, relays, push buttons, and wiring necessary for door operation.
  - c. Existing card access and keypad device shall be relocated as shown and integrated into new door operator control sequence.
  - d. Existing balanced magnetic switches shall be relocated and re-wired to the extent required. See details on drawings.
  - e. Reprogram ESS for sequence of operation of the doors.
  - f. Ensure wiring for remote testing of BMS is installed and working. Include in PVT.
  - g. Door alarms associated with existing video surveillance camera # 1SA800.2 covering this access control point shall be maintained and included in PVT.

3. Change Rooms and Shower Rooms:
  - a. Doors leading to these areas shall be provided with passage hardware sets for free entry and free exit.
  - b. Change Room and Shower Room areas are scheduled for use by both male and female occupants at different times. At each door to these areas provide illuminated, color coded, "IN-USE" signage to identify occupants.
  - c. Sign shall utilize blue and red LEDs on a black background. Whenever blue LED letters are illuminated "MALE OCCUPANTS ONLY" the female LED letters shall be blacked out and vice versa.
  - d. Each IN-USE sign shall be wall mounted at 5'-8" above finished floor to center of device on the strike side of each door as shown on drawings.
  - e. Provide in-use sign control switches wall mounted on interior of each room at strike side of door. The switches shall be three position maintained contact with stainless steel faceplates engraved with the message "MALE/OFF/FEMALE".
4. Existing exterior Door 1ST7 at Stair 7 shall remain. This door is an exit-only alarmed door with delayed egress push bar and alarm horn.
5. A new emergency exit door shall be provided from EDS area into Stair 7. This door shall be provided with a balanced magnetic switch (BMS) and alarm horn. BMS shall be wired for remote test function to be actuated by manual command at an existing guard desk workstation. Existing BMS in Bldg. 8100 are Securitron model MSS-1-RT. Refer to wiring detail on drawings.
6. Existing card reader controlled door 1SA202.1 leading from Tunnel 1SA233 to EDS area shall remain. Modifications to tunnel access or entry to the EDS area from the Tunnel are not required.
7. Ante Room 1SA204:
  - a. Equipment, devices and hardware associated with Door 1SA207.1, an existing card reader controlled door, shall remain. Existing interior vestibule door scheduled to be removed has no security requirements. The new door to be added for entry into the Control Display area shall be provided with passage set hardware and has no security requirements.
8. Stair Vestibule 1SA207:
  - a. Door 1ST8.2 is an existing card reader controlled door that shall remain. The existing interior vestibule door at this location shall also remain and has no security requirements.

#### D60 1.7 EMERGENCY TWO-WAY COMMUNICATION SYSTEM

1. Two (2) hands-free speakerphone stations shall be provided, one in EDS Room and one in Tank Storage area as shown. Intended use is rapid two-way communication with Control Display room personnel. Speakerphone stations shall be tied into existing PBX in Tele/Data2 Room 3NA113. See Security Phone Riser in Appendix N and related drawings and product data sheets

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2. Provide matching digital desk phone with LCD display of caller ID information to be located at OWS in Control Display Room 1SA204.1.
3. Expand existing PBX if required to accommodate new speakerphones.
4. Single button speaker phone stations shall be programmed to automatically dial Control Display desk and if not answered, to automatically dial a second number. Coordinate with Government.

### **D60 1.8 INTRUSION DETECTION SYSTEM**

1. Existing Intrusion Detection System (IDS) is an integral part of the overall building ESS. IDS components related to new SSP work consists of existing balanced magnetic switches (BMS) in existing card reader controlled doors where shown on drawings. Maintain operation of existing IDS components.
2. New BMS shall be wired for remote test feature matching existing BMS. See details on drawings.

### **D60 1.9 DURESS ALARM SYSTEM**

1. Duress alarm system components include under desk mounted hold-up button and emergency two-way communication system speaker phones described herein.
2. Hold-up button shall be wired to nearest spare input on existing Andover Continuum access control panel and programmed to annunciate at existing guard desk.

### **D60 1.10 VIDEO SURVEILLANCE SYSTEM**

1. Camera Types:

Cameras shall be Full HD 1080p, dome style, pan/tilt/zoom, latest versions available from manufacturer, and shall be tested and listed as compatible with existing IP network equipment, video recording system, monitors and display controls and compliant with National Defense Authorization Act for Fiscal Year 2019.

Four (4) networked IP cameras shall be provided in EDS Room, Filter Rooms and Mechanical Rooms as shown. Cameras are intended for general surveillance of area, equipment status and remote assessment of spill alarms.

2. Cabling and Video Transmission Standards:

Existing installation utilizes fiber optic cables to each camera in accordance with AR 190-17 "Biological Select Agents and Toxins Security Program" dated 3 September 2009 - Section 5-18 "Closed Circuit Television". Provide video transmission cables and hardware to match the existing methods of video transmission including copper cables for 24VAC power and fiber optic cables with media converters for video transmission. See Appendix N – Submittals As-Built

3. Operator workstation (OWS):

Provide new OWS, computer, monitor, keyboard, mouse, PTZ controller keyboard, and software. Configure OWS login to match existing PIN and biometric login requirements.

Setup OWS to enable users to view cameras in EDS area only while preventing access to other components of the security network.

Install OWS in the Control Display room. Provide new data outlet with cables back to existing security data rack for connection to existing security network.

OWS shall match existing, or latest compatible and comparable model available from manufacturer. See Workstation Product Datasheet in Appendix N – Submittals.

4. NDAA Compliance - Cameras, Ethernet Switches, Network Products:

Manufacturers or products not listed as prohibited in the National Defense Authorization Act for Fiscal Year 2019 are permitted to be used on the Work of this project.

NDAA Non-Compliant Products: Section 889 of the National Defense Authorization Act for Fiscal Year 2019 prohibits Federal agencies from purchasing video surveillance equipment (VSE) either: a) produced by certain “Covered” manufacturers or their subsidiaries or affiliates, or b) containing substantial or essential components produced by those manufacturers, or their subsidiaries or affiliates.

-End of Section-



CHAPTER 6  
D70 FRCS Cybersecurity

**D70 FRCS CYBERSECURITY**

This section describes the design scope and criteria to be applied for all Facility-Related Control Systems (FRCS), which is defined as a system which controls equipment and infrastructure that is part of a DoD building or structure. The primary governing standard to be applied is the Department of Defense (DoD) Unified Facility Criteria (UFC) 4-010-06, CYBERSECURITY OF FACILITY-RELATED CONTROL SYSTEMS. All facility-related control systems are subject to the requirements as specified in UFC 4-010-06 as well as supporting standards and guidances unless otherwise stated.

This section will be referring to multiple field control systems that interconnect and the infrastructure/platform enclave that connects them as a control system group, which could be viewed as being a single facility-related control system.

The facility is preliminarily rated as Mission Essential. The contractor is to coordinate with the government on any changes to the facility mission rating. The final classification of all systems shall be coordinated and approved by the Authorizing Official (AO).

**D70 1.1 GENERAL SCOPE OF WORK**

1. The cybersecurity requirements identified in this section are not sufficient to procure a control system and must be used in conjunction with other discipline requirements relating to facility-related control systems. Incorporate cybersecurity requirements into project facility-related control systems identified in:
  - a. C10 PROCESS – EFFLUENT DECONTAMINATION SYSTEM
  - b. D10 PLUMBING
  - c. D20 FIRE PROTECTION
  - d. D30 HVAC
  - e. D40 CONTROLS
  - f. D50 ELECTRICAL, LIGHTING, FIRE ALARM, AND INFORMATION TECH
  - g. D60 ELECTRONIC SECURITY SYSTEM
2. The Designer of Record (DoR), utilizing UFC 4-010-06 as well as other supporting documents, will supply a Basis of Design (BoD) detailing information about the scope of each control system and their requirements. Additionally, a Control Correlation Identifier (CCI) list should be supplied for each control system group.
3. The Designer of Record (DoR) is responsible for tailoring the applicable Division 25 Sections of Unified Facility Guidance Specifications (UFGS). The sections should be tailored to align with other sections concerning FRCS design as well as following all applicable cybersecurity requirements and guidances.

**D70 1.2 POINTS OF CONTACT**

1. The Point of Contacts (POCs) to be utilized for FRCS cybersecurity requirements:

- a. Robert Zendler, Cybersecurity & IT Branch, USACE Huntsville, (256) 895-1664  
[robert.f.zendler@usace.army.mil](mailto:robert.f.zendler@usace.army.mil)
- b. Daniel Shepard, Chief, Cybersecurity & IT Branch, USACE Huntsville, (256) 895-1178, [daniel.a.shepard@usace.army.mil](mailto:daniel.a.shepard@usace.army.mil)

### D70 1.3 FACILITY-RELATED CONTROL SYSTEM (FRCS) OVERVIEW

1. The Designer of Record (DoR) will perform the following tasks:
  - a. Identify all Facility-Related Control Systems (FRCS) involved in the design.
  - b. Identify the System Owner (SO) point of contact for each FRCS.
  - c. Identify the RMF Authorizing Official (AO) for each FRCS.
  - d. Determine the relevant Control Correlation Identifiers (CCIs), detailed in subpart 1.4.
  - e. Describe what equipment is to be provided by the project and what equipment is expected to be government furnished or included in a separate project.
  - f. If workstations or servers are to be supplied for a FRCS, describe how they will be imaged and who is responsible for imaging them.
  - g. Using the Control System Reference Architecture, figured in UFC 4-010-06 Chapter 2, identify the work to be performed at each level of the FRCS and the responsible party.
  - h. Develop a high level/ notional network diagram in similar fashion to the UFC Control System Reference Architecture diagram for each FRCS.
2. Utilizing the information in other chapters and the Energy, Installations, and Environment (EI&E) FRCS Master List, the system groups and subsystems (i.e. field control systems) have been identified as the following:
  - a. Utility Monitoring and Control System (UMCS)
    - i. Front-End / Operator Workstations
    - ii. Heating, Ventilation, and Air Conditioning (HVAC)
    - iii. Heating Hot Water System (HWS)
    - iv. Chilled Water System (CHWS)
    - v. Electrical Distribution System (ES); with Building UPS
    - vi. Utility Metering System (UMS)
    - vii. Leak Detection System (LDS)
  - b. Effluent Decontamination Monitoring and Control System

- i. Front-End / Operator Workstations
    - ii. Effluent Decontamination System (EDS)
  - c. Fire & Life Safety System (FLS)
    - i. Fire Detection and Alarm System (FDAS)
    - ii. Mass Notification System (MNS)
    - iii. Fire Suppression System (FSS)
  - d. Electronic Security System (ESS)
    - i. Intrusion Detection System (IDS)
    - ii. Access Control System (ACS)
    - iii. Emergency Two-Way Communication System
    - iv. Video Surveillance System (CCTV)
    - v. Duress Alarm System
- 3. The cybersecurity rating for the facility has been determined to be MISSION ESSENTIAL. Cybersecurity C-I-A impact ratings (Confidentiality-Integrity-Availability) range from low, moderate, and high; with high meaning that a disruption would result in the most severe adverse effect. These preliminary levels were determined from a similar project done on the same base. Given the changing nature of cybersecurity threats and changes in design requirements, these ratings must be confirmed by the System Owners (SO) at the time of design.
  - a. Utility Monitoring and Control System (UMCS)
    - i. The system owner is presumed to be Ft Detrick DPW or Facility Management.
    - ii. Preliminary C-I-A Levels: LOW-LOW-LOW (L-L-L)
  - b. Effluent Decontamination Monitoring and Control System
    - i. The system owner is presumed to be Ft Detrick DPW or Facility Management.
    - ii. Preliminary C-I-A Levels: LOW-MODERATE-MODERATE (L-M-M)
  - c. Fire & Life Safety System (FLS)
    - i. The system owner is presumed to be Ft Detrick Fire and Emergency Services.
    - ii. Preliminary C-I-A Levels: LOW-MODERATE-MODERATE (L-M-M)
  - d. Electronic Security System (ESS)
    - i. The system owner is presumed to be Ft Detrick Army Garrison.

ii. Preliminary C-I-A Levels: MODERATE-MODERATE-MODERATE (M-M-M)

**D70 1.4 SECURITY CONTROLS**

1. Following the requirements as stipulated in UFC 4-010-06, the Designer of Record (DoR) will apply the 5-step cybersecurity design process. The following tables located in UFC 4-010-06 were created to assist the designer by pairing down anticipated DESIGNER controls: (See Chapter 5 of UFC 4-010-06 for Design Submittals)
  - a. TABLE H-4 lists the recommended DESIGNER responsible controls for LOW and MODERATE impact control systems.
  - b. TABLE H-5 lists additional recommended DESIGNER responsible controls for MODERATE impact control systems.
  - c. Therefore, if a system is deemed MODERATE, the DESIGNER would address the controls in TABLE H-4 and TABLE H-5.
  - d. TABLE H-6 and TABLE H-7 respectively list the recommended PLATFORM ENCLAVE controls for LOW and MODERATE. In essence, these are the controls that the DESIGNER could list as to be expected to be INHERITED if the system is on a network not solely maintained by the Information System Security Officer (ISSO).
2. The DOR, utilizing the tables from UFC 4-010-06, will provide one security controls list per facility-related control system group, as appropriate.
3. The DOR will classify each Control Correlation Identifier in each list as APPLICABLE, NOT-APPLICABLE, or IMPRACTICAL.
4. All supplied security overlays, including the NIST SP 800-82 guidance, will be applied to the security control requirements.
5. For the CCIs coming from the UFC tables, all being identified as “designer”, the designer of record must address the CCI by incorporating design requirements in the specifications that address the concern of the CCI. The UFGS sections do note which CCIs relate to specific subparts within the section.

**D70 1.5 FRCS DEFINITIONS**

1. Utility Monitoring and Control System (UMCS) is defined as being a collection of one or more building control systems and/or utility control systems and the associated UMCS Infrastructure. This system can sometimes be referred to as Building Automation System (BAS) or just Building Control System (BCS). In other words, this system will consist of the existing front-end workstation, the existing and new Field Point of Connection (FPOC) and network architecture, as well as the general and equipment specific controllers & interfaces. More information about this system can be found in section D40 of this document. This system will be an addition to an existing control system for the building and does not communicate outside the facility. There is future plans for a project to upgrade the BAS, which sits outside the scope of this project. The Contractor is responsible for all components and configuration up to and including the new Ethernet switch. Integration of the switch onto the existing network shall be performed only after receiving an Authority to Connect from the government.

2. Effluent Decontamination Monitoring and Control System will be a collection of subsystems responsible for decontaminating the effluent of the steam process. This system will be fully isolated from all other systems and have dedicated network architecture to support the multiple skids and controllers as well as monitor from several new operator workstations. This system will have a redundancy of (N+1) for all necessary controllers. More information about this system can be found in section C10 of this document.
3. Fire & Life Safety (FLS) System for Building 8100 is existing but will require modification for compliance with UFC and NFPA standards. The additions in the scope of this project include manual fire alarm stations and audible and visual alarm notification devices. There is no need for controls of the FA/MNS Control Systems to be redesigned or altered. More information about this system can be found in section D50, subpart 1.5 of this document.
4. Electronic Security System (ESS) is defined as the collection of Intrusion Detection System (IDS), Access Control System (ACS), Emergency Two-Way Communication System, Video Surveillance System (CCTV), and Duress Alarm System. Building 8100 Electronic Security System is existing and the scope of this project is only to expand the existing systems. The ESS contractor will be responsible for integrating new necessary devices that align with the current design. More information about this system can be found in section D60 of this document.

#### D70 1.6 SPECIFICATIONS

1. The following list of specifications are anticipated as the basis for this project. The list is not comprehensive, and the Designer of Record (DOR) must provide all specifications required to describe the project and requirements to be applied. The latest UFGS sections will be employed.
  - a. 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS
    - i. One per control system group.
  - b. 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION
    - i. One per front-end system being installed.
  - c. 25 08 10 UTILITY MONITORING AND CONTROL SYSTEM TESTING
    - i. One per front-end system being installed.
2. The DOR, utilizing the security control lists developed, will tailor and submit appropriate specifications for the identified facility-related control systems.
3. Ensure it is clear which requirements apply to which systems. With multiple systems, implement multiple subparts to create requirements specific to the control system. Since there are multiple system group, there will be multiple sections for the Division 25 specifications. When creating multiple sections use the fourth level specification numbering to differentiate the system groups and indicate which system the section refers to.
4. Within the UFGS 25 05 11, reference other UFGS Sections concerning the appropriate facility-related control systems as supporting references. Ensure the UFGS 25 05 11 is also listed in the applicable UFGS's for each FRCS.

**D70 1.7 ADDITIONAL CYBERSECURITY REQUIREMENTS**

1. A cybersecurity Subject Matter Expert (SME) shall be utilized in securing the facility-related control systems identified by the designer of record. The SME requirements should be specified into the 25 05 11 specifications under the "Qualification" subpart. It should be specified that the expert must have an Information Assurance Technical (IAT) Level II certification, which is detailed more in DoD 8570.01-m. It should also be specified that the expert be familiar with securing federal government systems as well as the risk management framework.
2. All facility-related control system shall follow any physical security requirement that are specified, especially systems with a moderate C-I-A rating.
3. Signals between facility-related control systems that are not designed to interconnect shall be via hardwired analog/digital inputs/output; digital communication protocols shall not be used.

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CHAPTER 6  
E10 Furnishings



**E10 FURNISHINGS**

**SYSTEM DESCRIPTION**

Fixed furnishings are part of the Structural Interior Design (SID). Design and documentation of movable furnishings are part of the Furniture, Fixtures, and Equipment (FF&E) Package.

Design and documentation of both SID & FF&E shall be funded as part of the construction contract. Purchase and installation of FF&E Package shall be funded separately as part of Collateral Equipment.

Movable furniture and furnishings (FF&E) for this facility may include, but are not limited to movable furniture systems, freestanding furniture, and other miscellaneous items to support facility functions.

FF&E estimate to be provided by DB Contractor. The estimate does not include the Contractor's Handling and Administration Rate (HAR).

Fixed furnishings (items that are fixed to the structure), such as casework are part of the construction contract.

**E10 1.1 GENERAL SYSTEMS REQUIREMENTS** Design and provide fixed and movable furnishings for all areas as developed during Activity programming and as indicated in Room Data Sheets (refer to Appendix B of this RFP). Design a complete FF&E package and prepare supporting plans and procurement data. FF&E items identified in this RFP are to be used as a guideline to assist in establishing the minimum facility requirements and do not relieve the Contractor's Interior Designer from developing a complete design package that incorporates ALL of the Activities FF&E requirements. Design in accordance with specific facility-type Unified Facilities Criteria (UFC) and in conjunction with UFC 03-120-10, Interior Design.

Provide services of an Interior Designer with a minimum of one of the following credentials: National Council for Interior Design Qualification (NCIDQ) certification, or state and/or jurisdiction Interior Design Certification, Registration, or License. This Interior Designer must prepare both the Structural Interior Design (SID) and the FF&E Package and participate in design charrettes and review meetings to develop the building design and floor plan Contractor's Interior Designer and any Specialists must not have any affiliation with products specified. Closely coordinate all fixed and movable furnishings selections and fully integrate the FF&E package with building systems and finishes.

Contractor's Interior Designer shall be responsible for designing and providing specifications for procurement of all FF&E, to include delivery and installation, for facilities built under this contract. Base FF&E specifications on General Services Administration (GSA) schedules, and other Federal contracts and complying with priorities found in Federal Acquisitions Regulation (FAR) Part 8.404.

Fully integrate the FF&E package into the design and construction schedule for the building.

Consider furnishings relative Sustainability Reporting for Design Build and UFC 1-200-02, High Performance and Sustainable Building Requirements.

**E10 1.2 FIXTURES, FURNISHINGS AND EQUIPMENT (FF&E)** Development of FF&E process must begin with the 60% design submittal. Submittals include fixtures, furnishings, and equipment specifications in accordance with functional activity requirements to produce an optimally functional facility. FF&E are all items that are not fixed to the structure, but are fully integrated with the building systems and finishes.

Develop design as described and in accordance with functional activity requirements. Include in design all loose furnishings required to produce an optimum functional facility, consistent with quality commercial design. Project also includes the preparation of specific detailed information for each selected item. Each

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submittal must demonstrate interaction thoroughly with requirements and complete coordination with the facility design and the SID.

For all projects, including fast track projects, the Contractor is responsible for sufficiently scheduling all SID/FF&E submittals early enough to obtain required Government approvals, and meeting all ordering and installation lead times to complete project by contract completion date.

These are minimum requirements and Contractor must provide any/all additional meetings and submittals that necessary to support Interior Design effort with FF&E and coordination.

Provide the following FF&E meetings and submittals;

1. FF&E Requirements Meeting: This meeting must occur upon completion of Design Development (or approximately 60%), prior to development of FF&E package. Submit minutes of this meeting within 7 business days.
2. FF&E "Over the Shoulder" Review: Prior to Preliminary FF&E Submittal Contractor's Interior Designer must meet with functional activity for an "over-the-shoulder" review to present preliminary FF&E options. These can be presented in a "loose" format for preliminary approval prior to the Activity presentation.
3. FF&E Concept Presentation: Contractor's Interior Designer must present approved preliminary FF&E package to the Activity for approval. This presentation includes loose format samples and catalog cuts. Sample boards are not required.
4. Best Value Analysis (BVA), "Over the Shoulder Review": Prior to issuing the BVA, Contractor must meet with functional activity for an "over-the-shoulder" review of the solicitation package. BVA Solicitation to include the following:
  - a. Copy of the BVA cover letter
  - b. BVA Solicitation form & Questionnaire
  - c. Technical Specification to establish minimum acceptable FF&E requirements
  - d. Room and Typical
  - e. Furniture Plans with Legends (PDF format)
5. Preliminary BVA Submittal - Contractor's Interior Designer must submit three (3) copies of the Preliminary BVA package. Provide this submittal in binder format and include the following:
  - a. Cover Title Page (project name, project #, submittal date, submittal title)
  - b. Table of Contents
  - c. Point of Contact List
  - d. Narrative of Interior Designer Objectives
  - e. Copy of all information sent to bidders and documentation that all required sources were contacted.

- f. BVA Spreadsheet
  - g. Solicitation Forms submitted by each bidder (cut sheets/highlighted pricing sheets/technical specifications, pricing, dealer and manufacturer qualification for each product showing that products meets all requirements.)
  - h. Response from UNICOR
6. Preliminary FF&E Submittal: Preliminary FF&E submittal is due at pre-final (100%) and must be presented to the Activity and Contracting Officer. Submit the following in a 3-ring binder (with the exception of the 16x20 color boards) for review and approval:
- a. Cover Title Page (project name, project #, submittal date, submittal title)
  - b. FF&E list (Cost Summary)
  - c. Furniture placement plans coded to the FF& list and furnishings specifications.
  - d. Specifications for furniture, furnishings, etc.
  - e. Catalog cuts and finish samples for all specified items.
  - f. 16x20 inch color boards of furniture/furnishings and finishes specified for Activity presentation to indicate overall design intent.
7. Final FF&E Submittal: Submit Final FF&E Package within 60 calendar days following receipt of review comments on the preliminary FF&E submittal. Final submittal must incorporate the following:
- a. Cover Title Page (project name, project #, submittal date, submittal title).
  - b. Table of Contents.
  - c. Manufacturer Contact List.
  - d. Procurement Data Sheets for each product indicating final finish and fabric selections.
  - e. Copy of Final Quote on Letterhead from the vendor determined to be the Best Value.
  - f. Best Value Determination Guideline sheets (completed and signed by the Contactor's Interior Designer).
  - g. CD copy of the final FF&E binder.
  - h. Final Finish Selections and Memo Samples for FF&E submitted in 8x10 binder format, using heavy-duty plastic sheet protectors.

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### **E10 1.3 FF&E CONSTRUCTION SUBMITTALS**

Submit any revisions or deviations caused by discontinued items to the Contracting Officer for approval by the NAVFAC Interior Designer.

SD-10 Operation and Maintenance Data.

List Operation and Maintenance Manuals for seating, systems furniture and keyboard trays.

### **E10 1.4 FIXED FURNISHINGS (SID)**

Fixed furnishings (SID) are funded as part of the construction project and are not funded as part of FF&E. Each submittal must demonstrate complete coordination with the facility design and with the package for movable furnishings.

Develop design as described herein and provide storage shelving and equipment racks,

### **E10 1.5 INTERIOR SIGNAGE**

Provide all necessary interior way finding signage including Room Signs, Safety, and directional signs. Interior signage is not collateral equipment. Interior signage shall demonstrate complete coordination with the facility design, SID and FF&E submittals.

### **E10 2.1 MOVABLE FURNISHINGS**

Design of FF&E package is funded as part of the construction contract base bid. Procurement, purchase and installation coordination of FF&E is a planned modification to contract and funded separately as part of Collateral Equipment.

Design and provide a FF&E package in accordance with UFC 3-120-10, Interior Design, and other portions of this RFP for all areas as developed during Activity programming to provide a fully usable and complete facility.

FF&E Package must include shipping, freight, handling, and professional installation, project management, handling, and applicable sales tax. Perform a Best Value Determination on a minimum of three manufacturers for orders exceeding a total procurement of \$3000 from an individual manufacturer. Provide documentation to the Government with the final FF&E package.

Contractor, as a planned modification, shall be authorized by the Government Contracting Officer to procure all furniture/furnishings in the approved final FF&E package using predominately negotiated Federal contracts as directed by Contracting Officer. When the modification for turnkey furniture procurement is exercised, the Contractor's proposed Handling and Administrative Rate (HAR) must not exceed 5% of the total cost of the FF&E, shipping, freight, handling, and installation. The HAR includes all of Prime Contractor's effort related to storage, coordination, handling and administration of subcontractors, all other associated costs and profit for procurement of FF&E. No other charges, fees, or markups shall be authorized. Establish and submit a fixed percentage figure, for administration effort of this modification (HAR), with the initial project proposal as part of the Contractor's Pricing Schedule.

Furnishings, Fixtures, and Equipment (FF&E) must include furniture, shop equipment, audiovisual equipment, and specialty equipment. Weapon racks, drying cages, and lockers are not considered FF&E. FF&E must be fully integrated with the building systems and finishes. FF&E may also include specialty items for which the customer activity must be responsible for specifying.

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Design and provide as required FF&E for all areas as developed during client programming. Design an FF&E package and prepare supporting plans and procurement data in accordance with the general interior design requirements in UFC 3-120-10.

### **E10 2.1.1 FF&E PACKAGE**

FF&E Package: Design and provide a fully usable and complete facility to include a FF&E movable furnishings package from Government supply sources according to Federal Acquisition Regulations. The FF&E shall include, but not limited to, systems and modular furniture, training and conference furniture, seating, tables, artwork, decorative window covering, specialty furniture and equipment, dormitory room furnishings, and accessories. The government shall provide separate funding for the FF&E package. Construction funds shall not be used. The FF&E Package must include shipping, freight, handling, installation and the Handling and Administration Rate (HAR) percentage as applied to the final FF&E total cost.

#### **E10 2.1.1.1 AUTHORIZATION**

Government shall provide separate funding for procurement of FF&E package. Upon receipt of required funding, Contractor must be authorized by Contracting Officer as a planned line item modification to the contract/task order to procure all FF&E using predominately negotiated Federal contracts. Amount of the modification shall be the actual cost of these items from the Federal price schedules, including any freight and installation charges from furniture supplier as well as Contractor's FF&E Handling and Administration Rate (HAR). HAR includes all prime Contractor's effort related to storage, coordination, handling, administration of subcontractors, and all other associated costs and profit for the procurement of FF&E. Prime Contractor shall propose in the contract/task order solicitation the FF&E HAR. Contractor's proposed HAR may not exceed 5% of the total FF&E costs, as noted on the bid schedule. No other charges, expenses, fees, or markups shall be authorized.

Government shall approve the final FF&E submittal. The FF&E package shall be presented to Contracting Officer and Contractor must provide the FF&E exactly as specified and approved.

### **E10 2.1.2 PURCHASE AND INSTALLATION**

Coordinate building completion date with installation dealer of the FF&E Package. T Not Used. Contractor is responsible for the following: issuing purchase orders, receiving acknowledgements, sending copies of purchase orders to the installation dealer(s) specified in the FF&E package, and providing necessary deposits to furniture manufacturers.

The FF&E installation dealer(s) is responsible for the following: Receiving and installing all FF&E specified in the FF&E package, coordinating delivery and installation with the Contractor, inspecting for damage, providing delivery receipts to the Contractor, filing necessary freight claims, hanging artwork, bulletin boards, etc., removing packaging material, cleaning up the site upon completion, and adhering to Contractor's safety requirements.

#### **E10 2.1.2.1 USE OF GSA SCHEDULES AND BLANKET PURCHASE AGREEMENTS (BPAS)**

Prime Contractor or FF&E dealer shall be authorized to purchase supplies or services from GSA Schedules.

#### **E10 2.1.2.2 DEPOSITS**

When placing their order, Contractor must anticipate providing a deposit equal to 30% to 50% of furniture costs.

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Manufacturer price increases must be anticipated. Recommend ordering FF&E product once funds are received to avoid incurring additional costs. Delayed production and delivery dates can be noted at the time of order placement to coincide with building completion dates. Any costs incurred due to manufacturer price increases shall be the burden of the Contractor.

### **E10 2.1.2.3 DAVIS BACON WAGES**

Davis Bacon wages do not apply to the FF&E installer from the government supply sources. The workforce for the FF&E installation and delivery must be separate and distinct from the labor workforce performing under the construction contract.

### **E10 2.1.2.4 SALES TAX**

Exemptions for certain State or Local taxes may be available to the Contractor and/or its subcontractors. The Contractor must take maximum advantage of all exemptions, including obtaining a resale permit, from State and Local taxation authorities whether available to it directly or available to the Contractor based on an exemption afforded the government. The responsibility for paying applicable taxes rests with the contractor. State and local taxes applicable to the FF&E line shall be included with the subcontractor's quote, if applicable.

### **E10 2.1.2.5 BONDS**

FF&E line item is not considered construction and the prime Contractor shall not be required to secure any additional bond for the award of the FF&E line item unless otherwise indicated in the RFP. If any additional bond is required for the FF&E line item it is to be included in the prime Contractor's FF&E HAR.

### **E10 2.1.2.6 UNIQUE ITEM IDENTIFICATION (IUID) AND VALIDATION**

Unique item identification and valuation is a system of marking and valuing items delivered to DoD that enhances logistics, contracting, and financial business transactions. The IUID policy is mandatory for all DoD contracts that require the delivery of items. An item is a single article or a single unit formed by a grouping of subassemblies, components or constituent parts. Provide DoD Unique item identification, valuation and delivery of data for all required FF&E items for which the government's unit acquisition cost is \$5,000 or more.

### **E10 2.1.2.7 BUY AMERICAN ACT AND TRADE AGREEMENT ACT**

All supplies under the FF&E line item are subject to the Buy American Act and Trade Agreement Act (TAA). The GSA contracts and NAVSUP Blanket Purchase Agreements are required to comply with the Buy American Act and TAA.

### **E10 2.1.2.8 SMALL BUSINESS REQUIREMENTS**

The FF&E is subject to the Contractor's Small Business Goals however the government requires the furniture be purchased from NAVSUP Blanket Purchase Agreements (BPA). Most manufacturers on the Office Furniture BPA are large business and most manufacturers on the Dorm and Quarters BPA are small business. Installation dealers are small business. Under the terms of the BPA, the FF&E must be ordered directly through the GSA manufacturer. Using pass-through companies to achieve Small Business Goals shall not provide the Contractor credit unless they manufacturer 20% or provide 50% of the service purchased. The government shall not incur additional costs to use small business.

**E10 2.1.2.9 INSTALLATION**

The FF&E package includes the installation of all furniture and furnishings as specified in the FF&E package. The installation dealer specified in the FF&E package shall receive, store, if required, transport to the project site, off load, inside deliver, unpack, assemble, place/install, clean, if required, and dispose of all the trash for all furniture and furnishings. The Contractor's Interior Designer shall be responsible for specifying installation services and warehousing, as required, for all collateral equipment. It is the Contractor's responsibility to coordinate the building completion, occupancy, and furniture installation dates with the installation dealer specified in the FF&E package. Any costs associated with storing or delaying furniture shipments is the responsibility of the Contractor.

**E10 2.1.2.10 INSTALLATION WARRANTY**

Install all movable furnishings in accordance with the manufacturer's instructions and warranty requirements. All movable furnishings must be level and aligned and all doors, drawers and accessories must be level and aligned to open, close and otherwise operate smoothly and securely. All systems furniture must be installed by the systems furniture manufacturer's dealer of record and not the General Contractor. Repair, to the customer's satisfaction, any/all damage to any facility finish that is a result of the furniture installation and correct all punch list items for the furniture/furnishings.

**E10 2.1.2.11 ORDERING DOCUMENTATION**

Provide two copies of all ordering documentation to the Contracting Officer including Factory Order number (FO) and warranty information.

**E10 2.1.2.12 POST AWARD CHANGES**

After award of the FF&E line item modification, any request to change the FF&E items must be submitted on the Contracting Officer. The FF&E modification has been accepted, priced, and negotiated based on specific line items as detailed in the final package. Those items have been agreed to considering color, specific type and quality of material, price, sustainability, life cycle, and dealership service. The Government shall expect and require the Contractor to provide exactly those items. Should changes become necessary, careful consideration is required to ensure that equivalent quality, price and other aspects of the item are maintained. Otherwise, price adjustments must be negotiated. The Contracting Officer shall obtain approval from the Government Interior Designer/Collateral Equipment Manager in consultation with the client for any changes to the FF&E.

Post award FF&E manufacturer's price increases are the responsibility of the Contractor and shall not be transferred to the government. Recommend ordering FF&E product once funds are received to avoid incurring additional costs. Delayed production and delivery dates can be noted at the time of order placement to coincide with building completion dates.

**E10 2.1.3 BEST VALUE DETERMINATION**

A best value determination is required by Federal Acquisition Regulation (FAR) 8.404 when placing orders against Federal Supply Schedules for the selection of furniture and furnishings. A Best Value Determination (BVD) must also be provided for FF&E installation services. Best Value is defined in FAR 2.101 as ensuring that the order to be placed under a Federal Supply Schedule results in the lowest overall cost alternative (considering price, special features, administrative costs and client's needs) to meet the government's needs.

The Contractor's Interior Designer is responsible for the following written BVD justifications:

\$3,000 or less: For any procurement in the FF&E package with a value of \$3,000 or less, the Interior

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Designer may utilize any BPA holder. If the BPA holders cannot supply the item, then any other manufacturer may be utilized.

Greater than \$3,000 and \$150,000 or less: for any procurement in the FF&E package with a value greater than \$3,000 and \$150,000 or less, the Contractor's Interior Designer must always review pricing from at least three manufacturers as well as UNICOR. In addition to the review of published list prices, the Contractor's Interior Designer must confirm the pricing with the vendor. Manufacturer's quotes are NOT required. The BVD form must be completed and submitted for all FF&E procurements greater than \$3,000 and \$150,000 or less.

Greater than \$150,000: The Contractor's Interior Designer must solicit proposals from all BPA holders under the applicable group for FF&E procurements greater than \$150,000. UNICOR must always be solicited. The Contractor's Interior Designer must develop performance criteria and project requirements based on a generic design for the BPA holders and UNICOR to develop a price and performance proposal. The BVD form must be completed and submitted for all FF&E procurements greater than \$150,000 and manufacturer's quotes and a summary of all proposals must be attached.

The best value determination must address issues such as space planning; human factors data related to anthropometrics (reach, clearance, adjustability), space, and acoustics; ergonomics; product quality (including construction and materials); sustainability features, product warranties; history of the product and/or manufacturer; ability to service products through dealers or others within a certain geographical range of the project; price (including freight); aesthetics; appropriateness; and lighting, power and telecommunications systems management and/or coordination as related to the facility (when applicable); and other project specific factors as identified and/or required. Emphasis must be to create a fully integrated design solution by providing quality products to meet the functional needs of the customer. Customer preferences must be considered. The focus must be on the best overall value. Use the GSA Best Value Determination forms provided in Part 6 of this RFP as guidelines for information to be provided.

### **E10 2.2.1 FURNITURE SYSTEMS**

Provide products that meet the NAVFAC performance specifications for systems furniture. The Government Interior Designer must approve any other systems furniture manufacturer. The typical workstation must maximize each allocated space with work surfaces and overhead closed storage with a surface to accommodate a Government provided computer. An attached articulated keyboard/mouse tray must be selected or provided. Provide a monitor lift if required by the project program.

Powered raceways that shall accommodate data and voice wire management must be completely coordinated with all facility systems. The Contractor's Interior Designer must ensure the coordination of all electrical/data and furniture locations. Use of power poles shall not be permitted to power FF&E. Provide and coordinate all telecommunication receptacles and outlet requirements (i.e. RJ 11/45 receptacles and cover plates) with the Contractor's Interior Designer and the systems furniture installer. Hardwire all pre-wired furniture with the building systems, and coordinate all Information technology (IT) and telephone connections.

### **E10 2.2.2 FREESTANDING FURNITURE**

Provide ergonomic task seating, storage and filing, tables, as required.

### **E10 2.2.3 TASK SEATING**

Provide task seating that is fully ergonomic and coordinated by finish and scale to the workstation. Seating specifications to include: adjustable arms, back, height, and seat pan; 5 star base, appropriate castors for floor surface, lumbar support and availability in a minimum of two (2) sizes. Task seating can be from the same manufacturer as the systems or major furniture supplier or other seating manufacturer



as approved by the government Interior Designer, provided it is determined to be a BPA "Best Value".

#### E10 2.2.4 TABLES

Provide single or multi-person work surfaces or tables as determined from user requirements. Where computers are used, provide tables with wire management capability or pre-wired tables to accommodate data/telecommunications requirements. Powered raceways that shall accommodate data and voice wire management must be completely coordinated with all facility systems. The Contractor's Interior Designer must ensure the coordination of all electrical/data and furniture locations. Provide and coordinate all telecommunication receptacles and outlet requirements, hardwire all pre-wired furniture with the building systems and coordinate all IT and telephone connections.

#### E10 2.2.5 FIXED PRESENTATION FURNISHINGS

Provide markerboards with porcelain on steel writing surfaces. Coordinate with building construction to include appropriate blocking or structural support for the installation of markerboards and tackboards.

#### E10 2.2.6 OTHER MOVABLE FURNISHINGS

Provide waste receptacles, recycling containers, fire extinguishers, clocks and other accessories as required.

-End of Section-

## CHAPTER 6

### F20 Selective Building Demolition

## F20 SELECTIVE BUILDING DEMOLITION

### GENERAL SYSTEMS REQUIREMENTS

Perform all off-site work necessary to meet the requirements of the project, local codes, reference standards, technical specifications and performance criteria.

Identify and obtain permits to comply with federal, state, and local regulatory requirements associated with this work. All variances identified during design and construction shall be reviewed with the Authority Having Jurisdiction (AHJ) and Government representatives for acceptance. For code interpretations or requests for proposed code or military criteria deviation request the Fort Detrick AHJ to be Code review agency to have Authority Having Jurisdiction for the project. AHJ to be HQ-USACE IAW following UFC 3-600-01. After construction the AHJ building code authority is turned over to Fort Detrick AHJ. AHJ actions shall be coordinated through USACE, which shall involve both parties. All permits during construction shall be established by the HQ-USACE IAW that has full authority on site. It shall be the responsibility of the Design Build contractor to confirm all permit requirement with HQ-USACE IAW.

Coordinate and obtain approval from the Contracting Officer for proposed haul route(s), work site access point(s), employee parking location(s) and material laydown and storage area(s).

### F20 10 BUILDING ELEMENTS DEMOLITION

This project includes the demolition of the following:

1. Removal of the concrete slab at the proposed tank storage and filtration area.
2. Selective removal of the exterior concrete panel system to provide a temporary construction egress opening for construction personnel, equipment and material during construction.
3. Selective removal of the exterior concrete panels to provide new intake air and exhaust louvers.
4. Removal of the existing effluent utility piping within the existing Interstitial Piping Area and replaced with a new piping system to the new EDS system. The existing USAMRID Building 8100 effluent system to the existing TEDS system to remain fully functional during demolition and construction.
5. Removal of existing concrete slab to provide access to new or existing underground piping as indicated on the Plumbing drawings.
6. Miscellaneous partition and door opening demolition as required to meet current design requirements.

All demolition materials and appurtenances must be properly disposed of in accordance with all applicable regulations. Maximize the use of deconstruction and recycling services. Before demolition can commence, any hazardous materials must be abated. Provide a Demolition Plan/ Deconstruction Plan that is based on a Registered Engineers Survey in accordance with EM 385-1-1 and has been approved by the DOR. Obtain approval from the Contracting Officer for the proposed demolition plan and work/outage schedule prior to demolition activities.

Prior to demolition, contractor to provide material and labor to provide dust protection and material to protect all equipment and utilities that are not scheduled to be demolished. During demolition and construction the protection material and dust protection measures to be maintained. All equipment, building elements, and

utilities not scheduled to be removed are to be protected during demolition. Any damaged equipment, utilities or building elements to be or replaced to the original condition.

#### F20 10 1.1 GENERAL DEMOLITION

Remove indicated existing structure as described in section F20 10

The work includes demolition, salvage of identified items and materials and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Materials that cannot be removed daily must be stored in areas specified in the approved Demolition Plan as described in Specification Section 01 57 19.

#### F20 10 1.2 UTILITIES

Removal of all utilities within the current Interstitial pipe Space that interfere with the new proposed equipment layout. Utilities to include all waste lines from Upper level SL3 and BSL4 spaces. Electrical conduit, mechanical ductwork that conflicting with the new EDS equipment or new EDS support MEP equipment. Removal and/or connection of new under slab piping as indicated on the Plumbing drawings.

Remove existing utilities and terminate in a manner conforming to the nationally recognized code covering the specific utility. Disturbance to utilities cannot cause a failure to utilities to remain operational, unless a planned outage is approved by the FEAD/ROICC and coordinated with on-site personnel.

#### F20 10 1.3 DUST CONTROL

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area.

Perform dust control activities in accordance with approved Dirt and Dust Control Plan as described in Specification Section 01 57 19.

#### F20 10 1.4 TRAFFIC CONTROL

Where pedestrian, vehicle, aircraft safety is endangered, use traffic barricades.

#### F20 10 1.5 WEATHER PROTECTION

For portions of the building to remain, protect building interior, materials, and equipment from weather at all times.

#### F20 10 1.6 BURNING

Burning shall not be permitted.

#### F20 10 2.0 SUBSTRUCTURE & SUPERSTRUCTURE

Perform substructure or superstructure demolition work in accordance with this section (Section F20).

#### F20 10 3.0 EXTERIOR CLOSURE

Perform exterior closure demolition work in accordance with (Section F20).

For occupied buildings ensure openings to the exterior are secured by the end of the work shift.

## F20 10 4.0 INTERIOR CONSTRUCTION & FINISHES

Perform interior construction & finishes demolition in accordance with (Section F20).

## F20 10 5.0 PLUMBING SYSTEMS

At the time of the project demolition the existing drain piping from upper BSL3 and BSL4 spaces are assumed to not to contain hazardous materials within the enclosed piping, as the existing building has not been operational prior to connecting the existing piping to the EDS system. If any piping that is opened and removed, is determined to be contaminated with biological hazardous material, then the contractor is to follow the facilities SOP and this RFP procedures for decontamination of hazardous materials, prior to the contaminated material leaves the site. A unit price to be provided during bidding period to remove and decontaminate the hazardous material that shall be used during construction to determine the cost to remove hazardous piping material from site. The additional cost to be submitted to the owner as a Change Order" to the original contract. See specification section 01 22 00.10 for description of unit price requirements.

## F20 10 6.0 MECHANICAL SYSTEMS

Perform mechanical systems demolition in accordance with (Section F20).

## F20 10 7.0 ELECTRICAL SYSTEMS

Perform electrical systems demolition in accordance with Section F20.

## F20 10 8.0 OTHER NON-HAZARDOUS SELECTIVE BUILDING DEMOLITION

Perform non-hazardous selective building demolition in accordance with Section F20.

## F20 20 HAZARDOUS COMPONENT ABATEMENT

Perform work in accordance with specification and plans provided. Work to be completed following USAMRID standard procedures. Contractor to provide written description of method of removal of hazardous material from the facilities.

### F20 20 1.1 PRIVATE QUALIFIED PERSON (PQP)

The General Contractor is required to hire, as a first tier subcontractor, a PQP to ensure compliance with the approved work plans and perform independent inspections, testing and verification of the hazardous components work including hazardous waste.

The PQP must perform independent inspections, testing and verification of the hazardous components work as indicated in ESR Section F20 and the approved work plans as described in Part 2 Section 01 57 19. The PQP must be appropriately licensed in the state in which the work shall be performed.

### F20 20 1.2 WASTE CHARACTERIZATION

Perform inspection, decontamination and disposal of all hazardous waste in accordance with the USAMRID SOP's and this RFP, the specifications and plans provided.

### F20 20 1.1 DISPOSAL

All hazardous waste materials to be decontaminated on site by USAMRID personnel prior to exiting the

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site. Decontamination of all hazardous material to follow standard USAMRID (SOP) Standard Operating Procedures protocols for decontaminating material and personnel. Personnel removing utilities or equipment with hazardous material, to be fully trained in the methods of handling hazardous materials. The decontaminated waste shall become the property of the Contractor and must be transported, disposed of and recycled in accordance with the approved disposal plan as described in Part 2 Section 01 57 19.

### **F20 20 1.2 PLUMBING SYSTEMS**

Existing drain piping from upper BSL3 and BSL4 spaces are assumed to contain hazardous materials within the enclosed piping. All piping that is opened and removed to follow the facilities SOP and this RFP procedures for decontamination of hazardous materials, prior to leaving the site.

-End of Section-

ORIGINAL DOCUMENT SUBMITTAL

OCTOBER 14, 2022

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**CHAPTER 6**  
**G10 Site Preparation**

## G10 SITE PREPARATION

### SYSTEM DESCRIPTION

The site preparation activities consist of site clearing, demolition, salvage, relocation, earthwork, and hazardous waste remediation to ready the site for other work associated with the project.

### GENERAL SYSTEM REQUIREMENTS

Develop the project site and perform off-site work necessary to meet the requirements of the project, antiterrorism criteria, local codes, reference standards, technical specifications and performance criteria.

A topographic survey of the existing site has been performed and is included in Part 6. The topographic survey has been provided to show the location of existing facilities, areas of new work required by this RFP and the character of the sites. Prior to starting work, physically verify the location of all existing utilities and obtain additional survey data required to provide a quality final design. Perform a topographic survey in accordance with USACE EM 1110-1-1005 Control and Topographic Surveying, A/E/C CAD Standards, and/or additional USACE survey criteria included herein. Include the topographic survey in all design submittals. The existence, size, and location of the utilities are not guaranteed by the surveys provided. Verify the location of all utilities prior to construction. Electronic files of the topographic surveys shall be provided to the Contractor only after award of the Contract.

Unless otherwise noted, provide new facilities at the locations indicated on the drawings in Part 6.

Minimize the impact of construction activity on operations and neighboring facilities.

Identify and obtain permits to comply with federal, state, and local regulatory requirements associated with the work. Submit a complete Regulatory Compliance Checklist Form 124 with the first design submittal package. Determine correct permit fees and pay said fees. Forward copies of permits, permit applications, and the completed Checklist to the Government's Civil Reviewer and Environmental Reviewer. Perform work in accordance with the obtained permits.

Jurisdictional tidal and non-tidal wetlands have not been identified on the project site.

Coordinate and obtain the Contracting Officer's approval for proposed haul route(s), work site access point(s), employee parking location(s) and material laydown and storage area(s).

Refer to Site Analysis and Building Requirements Sections for additional site preparation functional program information.

### GOVERNMENT PROVIDED GEOTECHNICAL INFORMATION

Subsurface soil information for the proposed project area has been provided with this RFP. Refer to Section A10 - Foundations, and Appendix A – Geotechnical Report for RFP.

### G10 10 SITE CLEARING

Install erosion and sediment control devices prior to beginning clearing or grubbing operations.

If approved by the Government clearing and grubbing may be allowed to accommodate construction equipment within the designated construction laydown area.



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### **G10 10 1.1 GENERAL**

Clear and grub project site for project construction.

### **G10 10 1.2 BURNING**

Burning shall not be permitted.

### **G10 10 01 CLEARING**

The project site does not have saleable timber.

Timber on the project site noted for clearing and grubbing shall become the property of the Contractor. Remove timber from the project site and dispose of it off installation.

Burning shall not be permitted.

Clear trees, shrubs, brush and vegetation for construction of the project. Clearing includes the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared.

### **G10 10 01 1.2 PRESERVATION**

Preserve and protect trees, shrubs and vegetation not directly impacted by the construction in accordance with Part 2 Section 01 57 19, Temporary Environmental Controls, and PTS Section G205005, paragraph 1.1 Existing Plant Material to Remain or be Transplanted.

### **G10 10 02 TREE REMOVAL**

Remove trees as required for project construction.

Remove and dispose of trees to a depth of at least 18 inches (450 mm) below ground surface. Fill depressions with satisfactory material and compact. Mound fill 2 inches (50 mm) above adjacent surface to allow for settling when not part of a subbase

### **G1010 03 STUMP REMOVAL**

Remove all stumps under building foundations, roads, parking areas, hard stands, and storage areas as required for project construction to a depth of 5 feet below the finished grade.

Remove stumps to a depth of at least 18 inches (450 mm) below ground surface. Fill depressions with satisfactory material and compact. Mound fill 2 inches (50 mm) above adjacent surface to allow for settling when not part of a subbase.

### **G10 10 04 GRUBBING**

Within the clearing limits, remove and dispose of logs, shrubs, brush, matted roots, roots larger than 2 inches (50 mm) in diameter, and other debris to a depth of at least 18 inches (450 mm) below ground surface. Fill depressions made by grubbing with satisfactory material and compact to make the new surface conform to the adjacent surface of the ground.

G10 10 05 SELECTIVE THINNING

G10 10 06 DEBRIS DISPOSAL

Waste materials shall become the property of the Contractor; transport, dispose of or recycle waste materials in accordance with Part 2 Section 01 57 19, Temporary Environmental Controls.

Prevent spillage on pavements, streets, or adjacent areas. Dispose of surplus and unsuitable material off of Government property

G10 20 SITE DEMOLITION & RELOCATIONS

G10 20 1.1 GENERAL

Demolition work includes the demolition, removal and legal disposal of existing construction debris to accommodate the new construction. Take precautions to prevent damages to existing utilities, construction and materials not scheduled for demolition, repair or replacement; repair damages to the construction and materials to the satisfaction of the Contracting Officer and at no additional cost to the Government.

G10 20 1.2 AUTHORIZATION

Do not begin demolition until the Demolition Plan has been approved by, and authorization is received from, the Contracting Officer.

G10 20 1.3 TITLE TO MATERIALS

Whenever possible, salvage or recycle features demolished in lieu of disposing of as waste in a landfill. Existing features to be demolished which are not salvageable or reused become the property of the Contractor, and must be removed from the project site. The Government shall not be responsible for the condition, loss of, or damage to, such property after contract award. Materials and equipment cannot be viewed by prospective purchasers or sold on the site.

G10 20 1.4 REUSE OF MATERIALS AND EQUIPMENT

Remove and store materials and equipment to be reused or relocated to prevent damage, and reinstall as the work progresses.

G10 20 1.5 SALVAGED MATERIALS AND EQUIPMENT

Deliver salvaged materials and equipment that are to be removed by the Contractor and that are to remain the property of the Government to a storage site on the installation, in accordance with instructions of the Contracting Officer.

G10 20 01 BUILDING MASS DEMOLITION

Demolish a portion of the existing building in order to provide access opening.

Refer to Section F20, Selective Building Demolition, for additional information.

G10 20 02 ABOVEGROUND SITE DEMOLITION

G10 20 02 1.1 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of a building or on pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water for dust control if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements to control the spread of debris that may result in foreign object damage potential to aircraft.

#### G10 20 02 1.2 PROTECTION

##### G10 20 02 1.2.1 TRAFFIC CONTROL

Where pedestrian and driver safety is endangered in the area of removal work, provide traffic control in accordance with FHWA Manual on Uniform Traffic Control Devices (MUTCD).

##### G10 20 02 1.2.3 EXISTING WORK

Protect existing work that is to remain in place, be reused, or remain the property of the Government. At no additional expense to the Government, repair items that are damaged during performance of the work to original condition, or replace with new. Do not overload pavements to remain.

##### G10 20 02 1.2.4 NOISE POLLUTION

#### G10 20 02 1.3 PAVING AND SLABS

Remove concrete and asphaltic concrete paving and slabs as required for construction of project. Remove the existing aggregate base in areas to receive new pavement to the depth of the proposed pavement section below new finish grade. Remove the existing aggregate base in areas not to receive new pavement to a depth of 8 inches (200 mm) below existing adjacent grade and break remaining pavement (if any) to allow drainage. Provide neat sawcuts at limits of pavement removal; protect sawcuts so that new pavement butts against the existing without feathering.

##### G10 20 02 1.4 ABOVEGROUND STORAGE TANKS

The project site does require aboveground storage tank work.

Perform aboveground storage tanks work in accordance with the specifications and plans provided in Parts 5 and 6.

#### G10 20 03 UNDERGROUND SITE DEMOLITION

Remove or relocate existing utilities within 10 feet (3.0 m) of any new facilities or building additions. Existing utilities include but are not limited to piping, structures and conduits. Remove all appurtenances associated with the utility to be removed so there is no presence of the utility at ground surface.

Abandon utility systems in a manner that conforms to applicable codes and regulations. When piping is abandoned in place, provide a minimum 24 inch (600 mm) plug length. Remove existing utility structures to 3 feet (900 mm) below existing or new adjacent grade, whichever is greater. Break up bases to permit drainage. Backfill in accordance with UFGS Section 31 23 00.00 20, Excavation and Fill.

All conduits to be abandoned must abandon the wiring in place.

##### G10 20 03 1.1 UTILITY TERMINATION

Terminate utilities in accordance with state and local rules and regulations; the nationally recognized code; and the requirements of the utility provider covering the specific utility; UFC 3-201-01, Civil Engineering;

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and approved by the Contracting Officer.

### **G10 20 03 1.2 PROTECTION OF EXISTING UTILITIES**

Protect existing utilities to remain. Where removal of existing utilities and pavement is required, provide approved barricades, temporary covering of exposed areas, and temporary services or connections. Repair damage to existing utilities to remain at no additional expense to the Government.

### **G10 20 03 1.3 UNDERGROUND STORAGE TANKS**

The project site does not require underground storage tank removal.

### **G10 20 04 BUILDING RELOCATION**

Relocate building elements as indicated on the drawings in Part 6. Refer to Section F20, Selective Building Demolition, for additional information.

### **G10 20 05 UTILITY RELOCATION**

Repair relocated items that are damaged or replace damaged items with new undamaged items at no additional expense to the Government.

### **G10 20 06 FENCING RELOCATION**

Remove and replace post foundations. Repair relocated items that are damaged or replace damaged items with new undamaged items at no additional expense to the Government. Refer to Section G204001 for requirements for new fence systems.

### **G10 20 07 SITE CLEANUP**

Waste materials shall become the property of the Contractor; transport, dispose of or recycle waste materials in accordance with Part 2 Section 01 57 19, Temporary Environmental Controls.

Remove rubbish and debris from the installation daily; do not allow accumulations inside or outside the building(s) or on pavements. Store materials that cannot be removed daily in areas specified by the Contracting Officer.

#### **G10 20 07 1.1 SPILLS**

**G10 20 90 OTHER SITE DEMOLITION & RELOCATIONS**

**G10 30 SITE EARTHWORK**

**G10 30 1.1 GENERAL**

This section includes the design and construction requirements for earthwork and grading related to construction of the roadways, parking, paved areas and other related sitework. Refer to Section A10, Foundations, for earthwork related to construction of structures, including building, footings, foundations, retaining walls, slabs, tanks, and utility appurtenances.

The Designer of Record is required to utilize UFGS Section 31 23 00.00 20, Excavation and Fill, for the project specification, and to submit the edited specification section as a part of the design submittal for the project.

**G10 30 01 GRADING**

Provide site grading in accordance with the requirements of UFC 3-201-01, Civil Engineering.

**G10 30 01 1.1 ELEVATIONS**

Establish finish floor elevations in accordance with UFC 1-200-01, DoD Building Code (General Building Requirements), and UFC 3-101-01, Architecture.

**G10 30 01 1.2 SITE GRADING**

Grade the site such that associated storm water runoff does not adversely affect surrounding sites. Preserve natural topographic features to minimize the impact on the existing drainage patterns at and adjacent to the site.

**G10 30 01 1.3 FINISHED SURFACES**

Provide finish grading with drainage towards new and existing drainage features and with no resulting low spots that hold water or that direct runoff towards new or existing facilities or site amenities.

**G10 30 01 1.4 RODENT AND VEGETATION CONTROL**

Prevent and eliminate standing water.

**G10 30 02 COMMON EXCAVATION**

Preserve natural topographic features to minimize cut and fill requirements. Unsuitable material and surplus excavation becomes the property of the Contractor, and must be disposed of as indicated in the Project Program. Adhere to UFGS Section 31 23 00.00 20, Excavation and Fill.

**G10 30 03 ROCK EXCAVATION**

Rock excavation shall not be required for this project.

Do not make requests for additional compensation for degree of hardness or difficulty encountered in removal of material. Unsuitable material and surplus excavation becomes the property of the Contractor, and must be disposed of as indicated in the Project Program.

#### G10 30 04 FILL & BORROW

Adhere to UFGS Section 31 23 00.00 20, Excavation and Fill.

Backfill and fill material is available at the project site.

Top soil in the quantities required is not available at the project site.

#### G10 30 04 1.1 REQUIREMENTS FOR OFF SITE SOIL

For each borrow site, provide borrow site testing for hazardous materials characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Contracting Officer.

#### G10 30 04 1.2 SOURCES

Where sufficient topsoil and satisfactory materials are not available on the project site, provide suitable borrow materials.

#### G10 30 04 1.3 REQUIREMENTS FOR OFF SITE SOIL

Test off-site soil in accordance with UFGS Section 31 23 00.00 20, Excavation and Fill, section titled "Requirements for Off Site Soil".

#### G10 30 04 1.4 UNSATISFACTORY SOIL MATERIALS

Remove uncontaminated unsatisfactory soil materials from the site. Unsatisfactory materials are materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, backfills from previous construction or material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

#### G10 30 04 1.5 TOPSOIL

Refer to Section G2050, "Landscaping". Remove unsatisfactory, existing topsoil from the site in accordance with the Project Program.

#### G10 30 05 COMPACTION

Provide compaction in accordance with UFGS Section 31 23 00.00 20, Excavation and Fill, per the recommendations of the Contractor's Geotechnical Engineer.

#### G10 30 06 SOIL STABILIZATION

As recommended by the Contractor's Geotechnical Engineer, provide soil stabilization designed to function as required by site conditions in accordance with the State Highway specifications and standards in the state where the project is located. Apply and install geosynthetics in accordance with the manufacturer's written instructions.

#### G10 30 07 SLOPE STABILIZATION

As recommended by the Contractor's Geotechnical Engineer, provide slope stabilization through appropriate grading and site design for a minimum factor of safety of 1.5 or slope that does not exceed the maximum

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slope per local code requirements. Design and install manufactured products, gabions, geogrids, rock anchors in accordance with the manufacturer's written instructions. G10 30 08 SOIL TREATMENT

Chemically treat the entire foundation of each building for termites.

### **G10 30 08 1.1 Termite Control**

Refer to Section A1010 1.2, "Termite Control".

### **G10 30 09 SHORING**

Provide sheeting, shoring, bracing, cribbing and underpinning in accordance with the Army Corps of Engineer's Safety and Health Requirements Manual (COE EM 385-1-1), UFC 3-220-01, Geotechnical Engineering, UFC 3-301-01, Structural Engineering, and other Federal, State and local codes and requirements.

Provide protection of existing structures.

### **G10 30 10 TEMPORARY DEWATERING**

For bidding purposes, it shall be assumed that significant dewatering efforts shall not be required. The design of the temporary dewatering system is required to account for soil conditions, rainfall, fluctuations in the groundwater elevations and the potential settlement impact on adjacent facilities due to dewatering. Provide dewatering in accordance with UFGS Section 31 23 00.00 20, Excavation and Fill. While the excavation is open, maintain the water level continuously, at least 1.0 foot (0.30 m) below the working level.

French drains, sumps, ditches or trenches are not allowed within 3 feet (0.9 m) of the foundation of any structure without written approval of the Government's Civil/Geotechnical Reviewer.

### **G10 30 11 Temporary Erosion & Sediment Control**

Obtain Erosion and Sediment Control permit as required for the proposed work from the State.

#### **G10 30 11 1.1 Temporary Erosion & Sediment Control**

Develop and implement temporary erosion and sediment control measures and other Best Management Practices (BMPs) prior to or in conjunction with commencement of earthwork in accordance with the state Erosion and Sediment Control Laws and Regulations. Remove non-permanent erosion control measures after vegetation is fully established.

#### **G10 30 11 1.2 Maintenance**

Maintain temporary erosion control measures in accordance with state Erosion and Sediment Control Laws and Regulations throughout the project until areas are fully stabilized.

### **G10 30 90 OTHER SITE EARTHWORK**

#### **G10 30 90 1.1 STOCKPILED SOILS**

Adhere to UFGS Section 31 23 00.00 20, Excavation and Fill.

#### **G10 30 90 1.2 CLEAN FILL**

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Adhere to UFGS Section 31 23 00.00 20, Excavation and Fill.

### **G10 30 90 1.3 HISTORIC AND ARCHAEOLOGIC ARTIFACTS**

Refer to Part 2 Section 01 50 00.05 20, Temporary Facilities and Controls for Design-Build.

### **G10 30 90 1.4 PIPELINE CASING UNDER RAILROADS OR PAVEMENTS**

Where required by code or local practice provide casing for piping under railroads or pavements. The Contractor is responsible for obtaining permits from government and nongovernment owners/agencies as required to perform the work.

### **G10 30 90 1.5 TOPSOIL AND SEED**

Provide topsoil and seed according to UFGS Section 31 23 00.00 20, Excavation and Fill, except when landscaping is required.

### **G10 40 HAZARDOUS WASTE REMEDIATION**

The project site does not require hazardous waste remediation.

#### **G10 40 1.1 CONTAMINATED SOIL AND GROUNDWATER**

The project site does not require contaminated soil or groundwater work.

#### **G10 40 1.2 SPILLS**

In the event of a spill or release of hazardous substances, pollutant, contaminant or oil, notify the Contracting Officer immediately. Take immediate containment actions to minimize the effect of any spill or leak. Perform clean up at the Contractor's expense in accordance with the approved spill work plan as described in Section 01 57 19, Temporary Environmental Controls.

#### **G10 40 1.3 DISPOSAL**

Waste materials shall become the property of the Contractor; transport, dispose of or recycle waste materials in accordance with Part 2 Section 01 57 19, Temporary Environmental Controls.

Manage, transport and dispose of waste materials in accordance with specification and plans.

-End of Section-



**CHAPTER 6**  
**G20 Site Improvements**

## G20 SITE IMPROVEMENTS

### SYSTEM DESCRIPTION

Provide site improvements that support project sustainability goals of Part 2 Section 01 33 29.05 20, Sustainability Reporting for Design Build.

The site improvements consist of pavements and pavement related features, landscaping and other exterior site development work related to this project. Provide a pavement design by a licensed Professional Engineer familiar with conditions local to the project site. Site design, including but not limited to design of parking and pedestrian circulation, shall include coordination with the Civil Engineer and the Landscape Architect.

### GENERAL SYSTEMS REQUIREMENTS

Provide site improvements as required to make a useable facility that meets functional and operational requirements, incorporates all applicable anti-terrorism, force protection and physical security requirements and blends into the existing environment.

Provide accessibility in conformance with requirements of UFC 1-200-01 , DoD Building Code (General Building Requirements).

Identify and obtain permits to comply with federal, state, and local regulatory requirements associated with this work. Complete the Regulatory Compliance Checklist Form 124 with the first design submittal package. Determine correct permit fees and pay said fees. Forward copies of permits, permit applications, and the completed Form 124 to the Government's Civil Reviewer. Perform work in accordance with the obtained permits.

Minimize the impact of construction activity on operations and neighboring facilities.

Locate new site improvements at locations indicated on the drawings in another part of this RFP. If specific locations are not provided, site the improvements to develop appropriate and positive relationships with other facilities and to conform to existing development patterns.

Refer to Site Analysis and Building Requirements Sections for additional site improvement functional program information.

### G20 40 SITE DEVELOPMENT

#### G20 40 01 FENCING & GATES

Provide chain link security fence as indicated on the drawings in Part 6.

[Provide zinc-coated steel fencing components in accordance with FS RR-F-191/1, Type 1Provide top and bottom tension wires and bottom] rails; where tying into an existing fence, match fencing system.

[For the security fence, provide one single line fence surrounding the restricted area. Provide security clear zones as required. Ensure that the fabric height is at least 7 feet (2.1 m). Provide outriggers and three strands of barbed wire. Design security fencing in accordance with UFC 4-022-03, Security Fences and Gates.

#### G20 40 01 1.1 CHAIN LINK FENCE

Provide chain link fence designated as security fencing in accordance with paragraph G204001 - 1.3.

Provide chain link fence fabric that is at least 9 gauge (3 mm) steel wire mesh material (before coating) with mesh openings not larger than 2 inches (51 mm). Do not use aluminum fabric, posts or accessories. Install fence in accordance with ASTM F567 and the manufacturer's written installation instructions.

##### G20 40 01 1.1.1 TENSIONS WIRES AND TOP RAILS

Provide rails in accordance with FS RR-F-191/3, Class 1, steel pipe, Grade A.

##### G20 40 01 1.1.2 GATES

Provide gates in accordance with FS RR-F-191/2 with posts and fabric as specified for fence.

##### G20 40 01 1.1.3 POSTS AND BRACES

Provide posts and braces in accordance with FS RR-F-191/3, Class 1, steel pipe, Grade A. Brace each gate, terminal and end post with truss rods.

##### G20 40 01 1.1.4 FENCING ACCESSORIES

Provide fencing accessories in accordance with FS RR-F-191/4. If PVC coating is required, provide accessories with PVC color coating similar to that specified for chain-link fabric or framework.

#### G20 40 01 1.3 SECURITY FENCE

Provide security fencing systems in accordance with UFC 4-022-03, Security Fences and Gates, and this RFP.

##### G20 40 01 1.3.1 CHAIN LINK SECURITY FENCE

Provide chain link fence in accordance with paragraph G204001 - 1.1, excepted as noted otherwise. Ensure that the fabric has twisted and barbed selvage at the top and bottom. Do not provide top rails. Locate posts and structural supports on the inner side of the fencing. Install outriggers facing outward except when the fence is mounted directly on the property line.

##### G20 40 01 1.3.3 DRAINAGE CULVERTS AND UTILITY OPENINGS

Provide protective measures to prevent access through culverts, storm drains, sewers, air intakes, exhaust tunnels and utility openings or across drainage ditches or swales in accordance with UFC 4-022-03.

#### G20 40 01 1.4 OPENINGS IN PERIMETER AND SECURITY FENCING

Do not cover, block or lace openings in perimeter fencing and security fencing with material which would prevent a clear view of personnel, vehicles or material in the outer or inner vicinity of the fence line.

#### G20 40 01 1.5 FENCE GROUNDING

Ground and bond the fence in accordance with the National Electric Safety Code (NESC) - IEEE C2 and UFC 4-022-03. Ground fencing on either side of every gate and at other locations when the fencing is near

and parallel to high tension power lines. Grounding is also required at intervals of 1000 feet (305 meters) to 1500 feet (457 meters) when the fencing runs through isolated areas and at lesser distances depending on the proximity of the fencing to public roads, highways and buildings where the fencing is around or within explosive storage, production, operating or handling areas.

#### G20 40 01 1.6 ENCLOSURES FOR UTILITY EQUIPMENT

Where fencing is used to provide an enclosure for utility equipment, ensure a minimum clearance is provided no less than 3 feet (900 mm) around the equipment to permit maintenance access and ventilation. Provide stone, gravel or concrete paving within the enclosure.

#### G20 50 01 FINE GRADING AND SOIL PREPARATION

Provide 4" of topsoil for lawn areas and fine grade.

See Section G10, Site Preparation. Provide 4 inches (102 mm) of topsoil with appropriate soil amendments, as recommended by a current soil composition test, for areas to be planted with turf grass.

#### G20 50 02 EROSION CONTROL MEASURES

Prevent erosion from occurring by providing erosion control measures as required by city, state and federal requirements.

See Section G10, Site Preparation.

#### G20 50 03 SEEDING SPRIGGING AND SODDING

Seed areas indicated to be turfed in Part 6. Restore existing turf areas disturbed by Contractor operations that are to remain as turf areas. Restore by means of seeding and provide same guarantee and maintenance as for new landscape areas.

Hydroseed areas that are to be seeded and are larger than 1,000 square feet (92.90 square meters). Select hydroseed mix composition that is appropriate for surrounding land use and compatible and consistent with local application rates, seed availability and established practice in the project area. If project dates are unknown, specify required planting dates or alternative species for different seasons. Apply seed at a time best suited for germination of the selected species. Seeded areas are required to achieve a 95-percent coverage of the selected species and be weed free at the end of the Establishment Period.

#### G20 50 04 PLANTINGS

Preserve existing trees to the greatest extent possible. Select plant material from Master Plant Lists found within the Installation Design Guide (IDG). Other plants not found on these lists may be used if approved by the reviewing Government Landscape Architect. Final approval of new plant materials rests with the reviewing Government Landscape Architect.

#### G20 50 05 1.1 EXISTING PLANT MATERIAL TO REMAIN OR BE TRANSPLANTED

Preserve existing trees to the greatest extent possible. Identify preserved trees on the plans with tree species, caliper and dripline. Tag trees to be saved with plastic or vinyl tape tied to the tree caliper. Protect existing trees by fencing planting areas to remain from compaction and other damage with a barrier of metal poles a maximum 8 feet on center with plastic netting to a minimum of 10 feet (3.0 meter) radius from outside of the tree's trunk. Where tree drip lines are greater than 10 feet (3.0 meter) from the tree's trunk,

locate barrier fencing at the drip line of the tree. Install signs on each Tree Protection Zone fence indicating that the barrier is not allowed to be taken down or moved without the participation of a Certified Arborist. Ensure that the details and specifications clearly state that none of the following activities occur within the tree protection barricade: driving, parking, storing materials, dumping waste, concrete washout, adding fill soil, trenching, removing soil, grubbing, or other disturbance to the tree or the associated roots. Do not allow debris from tree or stump removal operations to fall on or otherwise damage plants that are not scheduled for removal. Do not remove plastic tape and barrier fencing until planting operations are ready to begin and/or instructed by the Contracting Officer. Replace existing trees to remain or to be transplanted that are unhealthy, that die, or have 20 percent or more of their crowns that die during the establishment period with healthy plants of the same species or variety during the appropriate planting season. During the landscape establishment period, replace trees, turf, shrubs, and ground cover that are damaged or destroyed during construction operations by the Contractor at no additional cost to the Government. At the direction of the Contracting Officer, remove the existing tree and stump and replace it with trees of the same genus and species equal to the total caliper of the existing tree. Provide replacement trees that are 4 inch (100 mm) minimum caliper. Replace shrubs with 5 gallon (18.9 liter) size container, ground cover with flat containers planted at 8 inches (200 mm) on center, and turf with sod, all of the same genus and species.

#### G20 50 05 1.2 UTILITIES

Do not place trees within 10 feet (3 meter) of above or below-grade utility line or structure. Within roadway sightlines, height of mature shrubs is limited to 3 feet (1 m) and trees must be limbed up a minimum of 6 feet (2 m) so their mature growth does not obstruct views from vehicle intersections or points of vehicle ingress or egress. Coordinate utilities between the Landscape Architect and appropriate disciplines.

#### G20 50 05 1.3 RECYCLING

Green waste: Contact the Public Works Department for potential green waste collection and hauling by the Government. Separate green waste not collected by the Government from construction debris and deliver to the base's or local landfill's green waste recycling area. Quantify and report diverted waste to the Contracting Officer.

#### G20 50 05 1.4 DRAINAGE

Provide for proper grading and drainage of turf and planting areas. Provide sub-surface drainage where soil or other conditions do not allow surface drainage. Do not drain roof gutters into planter areas.

-End of Section-

CHAPTER 6  
H10 Commissioning

## H10 COMMISSIONING

### PROCESS DESCRIPTION

Commissioning (Cx) is the process of ensuring that building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Government's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. Commissioning serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.

#### H10 1 GENERAL

##### H10 1.1 GENERAL DESCRIPTION

The Cx process shall conform to the U.S. Army Corps of Engineers (USACE) standard using the UFGS specifications (primarily 01 91 00.15 10' Total Building Commissioning). Per this standard, a single Commissioning Firm may be retained by the Design Build (DB) prime contractor to perform the Cx duties through both the design and construction phases. The Commissioning Firm and their team members shall have current Cx certifications as defined in 01 91 00.15 10. Refer to the section 01 91 00.15 10 included in the RFP. The Cx Firm team members shall include

1. Commissioning Firm Lead Commissioning Specialist (CxC): The CxC will be retained by the Commissioning Firm to lead and execute the commissioning process. The CxC must hold an applicable Cx certification and have documented experience in EDS commissioning.
2. Technical Commissioning Specialists: These are Cx specialists experienced in specific system disciplines and employed by the Commissioning Firm. These specialists must also hold an applicable Cx certification. This project will require a mechanical commissioning specialist and an electrical commissioning specialist, one of which can also be the CxC. The mechanical commissioning specialist must be highly qualified in the design, installation, and commissioning of high pressure steam and condensate systems.

USACE may retain a Commissioning Specialist (CxG) who will act in a Quality Assurance and approval role as agent to USACE and will confirm the commissioning requirements are completed per DB RFP requirements and USACE standards. The CxG may represent USACE in monitoring the Cx process and support / report to the Contracting Officer Representative (COR) and Resident Engineer. If USACE elects not to retain a CxG, the USACE technical support staff will be responsible for reviewing and approving the CxC documents and their performance under the DB contract. CxC shall collaborate with the applicable Government representative for commissioning activities.

##### H10 1.2 COMMISSIONING TEAM RESPONSIBILITIES

Commissioning Firm / CxC Responsibilities: CxC leading the Cx process for the Commissioning Firm shall generally have the following responsibilities which are further defined in 01 91 00.15 10,

1. Develop the design phase commissioning plan.
2. Review Cx requirements defined in the DB RFP, and provide the final commissioning specifications if any changes become necessary using the UFGS and applicable tailoring options during the design phase of the DB process if changes are dictated by USACE. Issue updates to assure alignment with each design phase submission.
3. Author the Cx narrative section of Basis of Design (BOD) narrative.

4. Participate in design reviews associated with each design phase submission to assure the design sufficiently supports the required commissioning of the project. The documents reviewed will include the Owner Project Requirements (OPR), BOD, the design drawings and specifications. Commissioning Firm specialists shall attend comment review meetings. The review comments from the CxC shall be documented in Dr. Checks at each design submission, please see 01 33 16.00 10 Design Data (Design After Award) Specification. Note the OPR to review will be that developed by the DB design team based on DD Form 1391 and the design charrette presentation and meeting minutes included in the RFP.
5. Conduct design phase commissioning meetings, including a design phase Cx kickoff and progress meetings, one per design submission.
6. Using the representative testing documents included in the DB RFP produce the final testing documents/forms for review and approval by USACE.
7. Ensure the factory testing requirements of the construction specifications clearly and thoroughly stipulate the requirements and acceptance criteria of the factory acceptance tests required.
8. Define the durations and the logic of the commissioning tasks within the contractor's overall construction schedule.
9. Develop the prefunctional checklists and review performance verification test forms (per specification section 23 09 00 to be provided by 23 09 00 contractor) which shall be completed by the applicable contractors during the QC and prefunctional activities. The level of detail shall meet the examples provided in this RFP at a minimum. The examples do not dictate format and CxC may submit their preferred format for approval.
10. Develop the construction phase commissioning plan.
11. Develop the Commissioning Firm/CxC Safety Plan and coordinate protocols with the Prime DB safety protocols.
12. Conduct construction phase commissioning progress meetings starting with the construction phase Cx kickoff meeting. Progress meeting frequency shall increase as the project moves into the startup phase and again as it moves to the testing phase. At a minimum, meetings up to the beginning of startup activities shall be monthly; be every two weeks until the start of functional testing, and weekly throughout functional testing. On days of functional testing, brief coordination meetings with parties involved in that testing shall be daily.
13. Review contract submittals for equipment included in the Cx scope to assure they conform with the design and UFGS requirements and sufficiently meet the Cx requirements. CxC or the technical specialists shall review and approve submittals prior to the prime contractor submitting those submittals to the Government.
14. Review and approve Factory Acceptance Testing protocols and testing scripts developed by the supplying manufacturer.
15. Develop the final functional performance tests scripts/checklists that dictate the functional test procedures to be executed by the Cx Team. Submit these for approval prior to test execution. Script format and content shall conform to the UFGS standard as detailed in 01 91 00.15 10 and shown on UFGS example templates.



16. Develop and maintain action list or issues log to record issues found and resolved during commissioning.
17. Attend factory installation and QC inspections and acceptance tests.
18. Coordinate with the construction team and MRDC/USAMRIID for establishing the procedures for entering DMLSS data (equipment nameplate and performance data and operation and maintenance procedures)
19. Attend Factory Acceptance Testing for the EDS.
20. Review and approve the Factory Acceptance Testing report.
21. Attend and witness representative QC, startup, and prefunctional activities to verify conformance with the Cx requirements.
22. Witness 50% of non-destructive weld testing of EDS piping, steam and condensate piping, HW and CHW piping, etc. All welded piping systems shall be witnessed. Specify this requirement in the applicable construction specifications.
23. Confirm DMLSS data entry accuracy via inspection of nameplate data and submittal information.
24. Specify the DMLSS data process outlined below in the applicable construction specifications.
25. Witness Testing, Adjusting, and Balancing (TAB) verification.
26. Witness Cybersecurity PVTs on EDS control systems.
27. Assess readiness for functional testing prior to beginning test execution. Review the QC and prefunctional documentation and inspect applicable systems and equipment to confirm readiness. CxC Technical Specialists shall certify reviewed completion of startup reports and PVTs per 01 91 00.15 10.
28. Direct and record the functional testing. CxC and/or their applicable technical specialists shall direct testing and record results. Review associated documentation.
29. Develop the Integrated System tests scripts/checklists that dictate the test procedures to confirm the integrated operation of multiple systems. The scripts/checklists shall be executed by the Cx Team, and directed and recorded by the CxC and/or their applicable technical specialists.
30. Review OM Manuals, Training Plans, Training Records, and warranty data
31. Lead and direct all functional testing integrated systems functional testing, and record all results
32. Develop Systems Manuals for the systems in the Cx scope.
33. Produce the final commissioning report.
34. Lead opposite season testing as applicable. Perform post construction "Endurance Test" in accordance with 01 91 00.15 10 and 23 09 00 as developed during the design phase.

Designer and Prime / Construction Contractor Cx Responsibilities – In addition to the Cx entities indicated above, all parties that are involved with the design, manufacturing, installation, quality control (QC), and testing of systems under the Cx scope are responsible for performing and/or participating in the Cx activities. Each entity shall designate a primary Cx representative for their firm who shall be the primary point of contact for Cx for that firm. The prime contractor shall designate a QC Manager (QCM) to represent the DB contract from the standpoint of Cx, and report to the USACE COR Quality Assurance Representative. The QCM may also designate discipline support QC managers to support the QCM. Detailed requirements of these entities shall be defined in the specifications; however, the following are general requirements:

1. The designers shall collaborate with the CxC to define the final Cx requirements in the design documents.
2. The responsibilities of the prime contractor, subcontractors, manufacturer's representatives, and specialized testing entities shall be defined in the design phase Cx specifications. These responsibilities include:
  - a. Construction scheduling as related to QC and Cx
  - b. Cx documentation preparation
  - c. Attend Cx meetings
  - d. Submit installation, QC and startup forms for approval
  - e. Submit application, installation, and startup requirements for relevant equipment and systems
  - f. Submit OM manuals for approval
  - g. Submittal of training plans for approval
  - h. Develop and submit for approval factory testing procedures and documentation
  - i. Factory test relevant systems. Record results and submit documentation
  - j. Submit DMLSS nameplate and maintenance data for entry by MRDC/USAMRIID
  - k. Inspect installations and confirm they conform to design requirements. Complete inspection checklists
  - l. Prime DB to coordinate all Cx activities and the relevant subcontractors and vendors throughout the Construction and Acceptance Phases.
  - m. Startup and perform QC/QA for the relevant systems. Prime Contractor performs the QA level
  - n. Record installation, QC, and startup documentation
  - o. Execute performance verification testing for relevant systems and record results. This will include primarily the BAS and EDS control contractors for both associated system operation and cybersecurity PVTs..

- p. Submit performance verification results
- q. Supply NIST certified instrumentation to conduct startup and testing
- r. Test, adjust, and balancing relevant systems
- s. Execute DMLSS PM tasks
- t. Declare readiness for functional testing
- u. Certify equipment required under the DB scope including HEPA filters and Vent filters
- v. Participate in Cx functional and Integrated System Testing
- w. Support bio-challenge testing of the EDS
- x. Respond to action items or issues identified during Cx.
- y. Conducting training and submitting training record
- z. Finalize all documentation and submit for approval
- aa. Participate in Endurance Tests required by 23 09 00
- bb. Participate in opposite season testing where applicable

#### H10 1.3 SYSTEMS TO BE COMMISSIONED

The following systems shall be included in the commissioning scope

- 1. Plumbing:
  - a. Biowaste drain piping
  - b. Biowaste Storage Tanks
  - c. Biowaste chopper recirculation pumps
  - d. Biowaste Drainage Filtration
  - e. Biowaste feed pumps
  - f. Continuous Effluent Decontamination System (EDS) skids
  - g. Biowaste recirculation piping
  - h. Clean in Place/Neutralization of Cleaning liquid (CIP)
  - i. HEPA Vent Skids
  - j. Water Softener
  - k. Domestic Cold and hot Water System

- a. Extension of Schneider DDC BAS
  - i. Database Servers updates
  - ii. Operator Workstations updates
  - iii. Network gateways and switches
  - iv. Controllers
  - v. Sensors
  - vi. Actuators
- b. EDS Manufacturer Redundant PLCs and Monitoring Workstations

- c. Interface to campus UMCS
- 4. Electrical
  - a. MCCs
  - b. Distribution panels and Transformers
  - c. Automatic Transfer Switches
  - d. Receptacles
  - e. Uninterruptible Power Supplies load extensions
  - f. Emergency Power Lighting Inverters load extensions
  - g. Lighting and Lighting Control
- 5. Fire Alarm System
  - a. Fire Alarm Control Panel extensions
  - b. Zone Addressable Modules added
  - c. Smoke and Heat Detectors added
  - d. Flow and Tamper Switches added
  - e. Audio and Visual Alarms, Strobes, Pull Stations, etc. added
- 6. Fire Suppression/Sprinkler System extensions
- 7. Security systems and components, with performance/functional testing by independent security subcontractor as agent to USACE
  - a. Access Control System extensions
  - b. CCTV System extensions

#### H10 2 FACTORY ACCEPTANCE TESTING (FAT)

The following manufactured equipment shall be factory tested.

- 1. EDS System
  - a. Biowaste Filtration Skids
  - b. Chopper Pumps
  - c. Biowaste Feed Pumps
  - d. Continuous Flow EDS Skids

e. Clean In Place Neutralizations

EDS Factory Fabrication Inspection and QC witness: During fabrication of the relevant manufactured equipment, manufacturer shall support periodic inspections of the factory fabrication including unit configuration, pressure tests and non-destructive weld tests.

EDS equipment manufacturer shall submit FAT procedures and expected results for review and approval by the Government Team prior to FAT test confirmation. Forms shall detail the testing processes and expected results including acceptance criteria. Forms shall include signoff of Government stakeholders and CxC witnessing the tests. Notify the CxC and Government stakeholders of these activities and schedule activities to support their attendance.

Manufacturer will be responsible for providing the required utilities (electricity, steam, condensate return/drainage, water flow, water drainage) and setup of the control and monitoring systems associated with the equipment being tested. Monitoring screens shall be configured to allow viewing by multiple team members.

Factory acceptance testing (FAT) will be performed in the manufacturer's facility and witnessed by the Government stakeholders and Cx team entities indicated above. The extent of FAT is dependent on the manufacture from which the equipment is procured (and their design of the equipment) and their capabilities. Generally, FATs shall include:

H10 2.1 EDS

1. Assume all components of the EDS system minus the storage tanks will be provided. Effluent can be piped to temporary tanks to simulate the storage tanks for purposes of testing filtration and feed pump sequences.
2. Inspection of chopper pumps, filtration skid, pump skids, CIP skids, EDS skid configuration of various components for all three skids.
3. Calibration checks of sensors.
4. Valve stroke and range and failure conditions.
5. Pump capacity, flow control, rotation, maintenance, and failure.
6. Sequence and performance testing: test at peak flow including injection of representative solids into filtration skids. Solids to inject shall be coordinated with USAMRIID but generally include animal waste and hair similar to that of USAMRIID research subjects, plastics found in animal toys, paper towels, sponges and 2ml plastic tubes from research labs. Solids volume shall be 3% of peak flow. Solids for testing shall be of various sizes to confirm the EDS system removes them through filtration and residuals do not foul the EDS skids). Confirm flows, temperatures, pressures, and retention time on the EDS skid. Open skids and inspect to confirm there is no evidence of solids fouling the tubes.)
7. Filtration Skid Maintenance Mode and Steam Sterilization process with cleanout and reactivation.
8. Clean in place and Neutralization process using the CIP skids cleaning the EDS skids.
9. Neutralization of CIP tanks and pump-out/drainage.

10. Process data collection and reporting.
11. Failures of controllers (PLC and RIOs as applicable) pumps, sensors and valves with confirmation of alarm enunciation required sequence/response.
12. Spore or active test material challenges shall be done on the EDS skids at the factory to prove the 6 Log 10 reduction in biological contaminants. Vendor shall propose the testing methodology.
13. Manufacturer shall submit final reports documenting the FAT processes and results with applicable witness signoffs.

### H10 3 EQUIPMENT INDEPENDENT CERTIFICATION

Exhaust HEPA filter modules and plumbing vent HEPA filters shall each be certified on site by an independent testing agency accredited for the applicable test. Exhaust HEPA filters shall be tested and certified in accordance with the latest version of ASME N510. On site test shall include Visual Inspection Tests (1), Airflow Capacity and Uniformity Tests (8), Air-Aerosol Uniformity Mixing Test (9), and In-Place Leak Tests of the HEPA Filters (10). Exhaust HEPA filter certification tests shall confirm the rated flow, pressure drop, and leakage. Plumbing HEPA vent filters shall be certified via the Water Intrusion Test (WIT) method and meet the leakage/evaporation rate stipulated by the manufacturer. Schedule certification close to beneficial occupancy date to maximize the period until the next annually required recertification.

### H10 4 PREFUNCTIONAL TESTING AND VERIFICATION

Prefunctional testing and verification of systems is required prior to declaring a system or equipment is ready for functional performance testing. Contractors, vendors, testing agencies, etc. are responsible for performing the installation verification, startup, quality control, and preliminary testing/performance verification testing that document that the systems are installed and operating per the design intent and contract requirements. Initial documentation of the required activities shall be done by the responsible subcontractors, vendors, and testing agencies as applicable to those systems. The party performing the activity shall coordinate with the Prime Contractor for scheduling of the activities. Prime Contractors shall notify CxC, designers, and Government stakeholders of the applicable activities who shall be permitted to witness those activities.

CxC in collaboration with the designers shall specify the requirements of the prefunctional activities and documentation in the design specifications.

Prefunctional Checklists (PFCs) shall be developed by the CxC as a summary verification that the required Cx activities have been completed. Responsibility to sign-off on the checklist items shall be included on the PFC along with a field to indicate the person signing off. Refer to the UFGS templates for level of detail with the exception that each system shall have its own checklists and allow multiple signoffs. Refer to examples in the RFP.

Performance Verification Tests (PVTs): PVTs are part of the Prefunctional testing requirements as specified in the applicable sections. These are generally associated with the BAS and EDS controls contractor/vendor. PVTs for systems control shall be stipulated in UFGS section 23 09 00 (developed by the 23 09 00 contractor) and test control of systems, equipment, rooms, etc.. PVTs for cybersecurity shall be stipulated in UFGS section 25 05 11 (developed by the EDS vendor) and test conformance to the USACE cybersecurity requirements. PVTs for Cybersecurity shall be executed by the EDS vendor and witnessed by the CxC as a combined PVT/FPT.

The requirements for EDS cybersecurity PVTs to be specified by the CxC and performed by the applicable control system vendor and witnessed by the CxC shall generally include:

1. Perform PVT actions to verify systems are installed in accordance with UFGS 25 05 11, Cybersecurity for Facility Related Control Systems
2. While PVT actions will primarily occur towards the end of the controls installation, some PVT actions will occur earlier in the project.
3. Submittals will describe specific cybersecurity related characteristics and describe specific steps taken to improve cybersecurity. Compare submittals to actual installed to verify accuracy and compliance. Pay particular attention to STIG/SRG submittals and documentation as well as any vendor-specific hardening guides.
4. Monitor basic cybersecurity posture during construction
5. Verify that only approved database software and web servers are used in the system.
6. Verify that devices are properly secured according to applicable STIGs, SRGs, and vendor provided hardening guides.
7. Verify that no wireless networks are used in the system.
8. Verify that the only protocols and traffic in the system are those required for functionality
9. Verify that there is no network connection to other system (hardware I/O allowed)
10. Verify that remote user interfaces use HTTPS
11. Verify that Ethernet switches block unneeded ports/protocols
12. Verify that device and user interface access is restricted to authorized users per specification. Verify that these restrictions are implemented by one or more of:
  - a. Being located inside space under the physical control of the missions
  - b. Being located in a properly locked and secured enclosure
  - c. Being located behind other approved physical barriers
  - d. Requiring a user to logon to a specific account for access where the device FULLY supports accounts
  - e. Requiring a user to logon to a specific account for access where the device MINIMALLY supports accounts
13. Verify that privileged user interfaces have been properly identified as those capable of significant disruption of critical missions and that those interfaces are properly secured.
14. Verify that devices FULLY supporting accounts have at least three levels of account permissions and that accounts can be created, modified, and deleted.



15. Verify that devices MINIMALLY supporting accounts have at least some actions that require the user to enter a PIN, password, or some form of authentication.
16. Verify that repeated unsuccessful logon attempts results in accounts being locked per specification.
17. Verify that computers use strong passwords.
18. Verify that any other user interface has passwords or PIN or physical security.
19. Participate in initial password setup/creation
20. Verify that user actions at user interfaces are properly logged and recorded per specification.
21. Verify accurate time stamps on alarms and user action logs.
22. Verify that audit logs can be exported as CSV or Excel.
23. Verify sufficient long-term storage of audit logs.
24. Verify that audit logs can be uploaded or otherwise transferred to long term storage and/or analysis tools.
25. Verify vulnerability scans of computers.
26. Verify proper installation of malware protection on computers.
27. Verify scans of system.
28. Verify content and applicability of cybersecurity training.
29. Verify that user interface sessions automatically lock and terminate per specification.
30. Verify that user accounts expire per specification.
31. Verify that network media inside mission space is installed in conduit or IMC.
32. Verify that network media outside mission space is installed in rigid conduit.
33. Verify that all devices outside mission space are installed in locked enclosures.
34. Verify that all IP controllers are installed in locked enclosures.
35. Verify that proper alarms and event logging has been configured in the system.
36. Verify that operators are notified if there is a failure in the auditing system.
37. Verify that auditing analysis tools are provided and that they can run reports combining auditing records from multiple sources.
38. Verify that no unnecessary user interfaces were provided.
39. Verify that there are no unnecessary software or applications provided on computers.

40. Verify that critical functionality does not depend on the network, or that redundant network paths are provided. Review submittals to determine dependency on network. Test for network faults.
41. Verify that the system do not use unapproved mobile code and does not attempt a download from off-site.
42. Verify that devices have electrical power at least as reliable as the controlled equipment.
43. Verify that devices properly recovery from power outages.

#### H10 5 EQUIPMENT DATA AND MAINTENANCE DOCUMENTATION

Prime DB Contractor and CxC shall establish the process for working with MRDC/USAMRIID to collect and enter equipment data and maintenance into MRDC's DMLSS maintenance management systems. Generally the process shall be:

1. Contractors shall obtain nameplate and performance data forms from MRDC/USAMRIID
2. Contractors shall collect the data from the equipment and submittals and complete the nameplate and performance data forms
3. Contractors shall place these in MRDC/USAMRIID's DMLSS inbox
4. MRDC/USAMRIID will enter this data into DMLSS, print a data sheet and place it in their DMLSS Outbox.
5. Responsible contractor shall take the equipment data sheet and confirm its accuracy. If any changes need to be made, they will comment on the data sheet and return it to DMLSS inbox.
6. Vendors or subcontractor responsible for the installation of a system or equipment shall type the maintenance the periodic maintenance requirements into an MS Word document outlining the applicable period (daily, weekly, monthly, quarterly, annual) maintenance activities that need to be performed. Print the document and place it in the DMLSS inbox
7. MRDC/USAMRIID will enter the maintenance procedures into DMLSS. They will then print out the maintenance plan and place it in the DMLSS outbox.
8. Responsible contractor shall take the maintenance sheet and confirm its accuracy. If any changes need to be made, they will comment on the data sheet and return it to DMLSS inbox.
9. Once any equipment has been started and left to run in automatic unattended, responsible contractor shall notify MRDC/USAMRIID of the start date.
10. MRDC/USAMRIID will schedule the required maintenance activities in DMLSS
11. Upon a maintenance activity being due, MRDC/USAMRIID will print out the applicable maintenance ticket and place it in the DMLSS outbox.
12. Responsible contractor shall complete the maintenance activity, complete and sign the ticket and place it back in the DMLSS inbox.
13. MRDC/USAMRIID will close the ticket.

**H10 5 FUNCTIONAL PERFORMANCE TESTING (FPT)****H10 5.1 FPT GENERAL**

Functional performance testing shall be performed on systems upon completion of the QC, startup, prefunctional testing, and TAB (as applicable) for that system with review of the applicable documentation of those efforts. The responsible contractors and vendors shall prepare a Certificate of Readiness for the relevant systems to be reviewed, and have the certificate signed-off by the CxC and Government stakeholders in advance of setting the final FPT date. Once a system or component is confirmed ready for functional testing, the CxC or their applicable technical Cx specialist will direct and record the testing. Relevant contractor team members (prime contractor, subcontractors, vendors, TAB, BAS contractors, and those applicable to the system) shall execute the testing using NIST certified instrumentation as required.

CxC shall develop the functional performance testing scripts using the UFGS format provided in the example FTP templates provided by the UFGS with sections included as required by section 01 91 00.15 10. Scripts must be submitted for review and approval by the Government prior to executing the test.

Functional performance testing shall begin with documentation and installation verification and continue with checks of input and output devices, verification of subsystem elements of the system, and progress to the functionality of the system being tested. Limits of components and systems on which to execute FPTs shall be determined so as to efficiently and expeditiously progress through FPTs. In some cases FPTs may be completed on individual components, equipment, or subsystems and then FPTs will be executed on higher level systems that include elements individually functionally tested. CxC shall develop the scripts for the various FPTs and organize and schedule them based on required prerequisites.

Functional performance testing shall be coordinated with Government stakeholders (USAMRIID Facilities and Safety, MRDC/USAMRIID, DA Safety) to allow participation and witnessing as desired. USAMRIID Safety may provide and confirm results of bioindicators to prove sterilization/decon acceptance.

FPTs shall be performed on all systems, equipment, rooms, and components in the Cx scope of this project. There shall be no sampling strategy less than 100%.

Following is a preliminary general list of FPTs to be completed and high-level summaries of the tests to be performed. CxC shall expand on the requirements for functional testing and clearly specify those requirements in the design specifications based on the finally determined system requirements and sequences of operation. CxC shall develop and finalize FPTs under the DB contract. Note that the sequences of operation of the EDS system will be developed by the DB Contract team in concert with the selected EDS vendor. Tests below are speculative and may either not apply or not represent all required tests. Tests listed below shall be performed when applicable to the final sequence of operation. They also establish an expected level of detail to be expanded based on the final sequences.

**H10 5.2 PLUMBING FPTs**

1. Storage Tank FPT: An FPT shall be conducted on each tank.
  - a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, confirm pipe pressure testing, installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, PVTs and sequence prefunctional testing.
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.

- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate. Confirm tank level and volume indication.
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Steady State Test: Before executing testing, observe and record the operating conditions of the tank. Confirm acceptable operating status exists.
- f. Sensor calibration tests including biowaste level (radar and switches), temperature, and pressure sensors.
- g. Valve operational checks; check open position and status and closed position and status and feedback on analog valves.
- h. Normal fill mode to lead storage tank with peak system flow
- i. During peak fill, isolate one of the paths in the vent filter. Observe pressure drop across active vent HEPA filters and confirm it is per rating.
- j. Drain Mode: confirm operation of lift pumps to maintain level at peak flow. Reduce biowaste flow and observe lift pump control and alternation of pump leads
- k. Inactive mode, rotate to another storage tank as lead and isolate current tank from fill and drain flow. Confirm valve positioning and tank status.
- l. Maintenance/Decon Mode: Discuss loading with spores/bioindicators prior to maintenance mode testing. Place tank in Maintenance Mode and confirm it Isolates the tank from effluent inlet flow and drainage flow. Insert SCBI spore ampules in biowells if requested by RIID. Drain effluent into drain system using lift pumps until level is to bottom of tank. Initial Decon Mode: After tank is drained, charge tank with steam. Confirm the tank is charged with steam for sterilization/decontamination for the stipulated time. Confirm steam powered drain traps lift steam condensate to active tank. Continue for rated cycle then allow cooldown. Initiate air pressure purge then open tank and cleanout solids. If applicable remove ampule and incubate to confirm spore 6 log 10 reduction.
- m. Simulate and confirm high level alarms
- n. Simulate and confirm Low level alarms
- o. Leak Detection: Simulate a leak on the tank by wetting the leak sensor cable. Confirm alarming, the proper indication of leak location, and required response.
- p. Simulate valve failures. Typically remove or override status indicators or analog feedback
- q. Simulate Sensor failures. Remove wiring
- r. Tank Remote Input/Ouput (RIO failure), remove communication then power to the RIO serving the tank.

- s. Confirm cycle reporting, data storage and report output.

2. Chopper Pumps

- t. Prerequisite documentation checks: review and confirm weld inspection and testing documents, confirm pipe pressure testing, installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, VFD startup, TAB, PVTs, sequence prefunctional testing, and endurance documents
- u. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- v. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate. Confirm VFD graphic and integrated points
- w. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- x. Steady State Test: Before executing testing, observe and record the operating conditions of the pumps. Confirm acceptable operating status exists.
- y. Sensor calibration tests including pressure sensors and flow sensors.
- z. Valve operational checks: Check open position and status and closed position and status and feedback on analog valves.
- aa. Off Mode Disable Chopper pumps and confirm pumps are off, valves position to the correct position, and status correctly shows pumps are off,
- bb. VFD Hand Operation: Confirm the ability to run pumps in HAND and vary speed.
- cc. Recirculation System Start: With VFDs in Auto, enable the Chopper pump system and confirm proper start of lead pump, valve positioning, pump acceleration to control loop setpoint, stable control at setpoint.
- dd. Normal Recirculation Mode: confirm operation of the assigned lead pump. Confirm flow through active storage tanks. Record electrical parameters with pump operating at peak setpoint. Confirm pump capacity and speed at peak operating condition. Verify flow and pressure through recirculation system. Spot check pump vibration. Vary setpoint for control loop to reduce capacity and confirm stable response. Confirm check valve isolates flow through lag pump.
- ee. Solids Injection: With system running normally, inject 3% solids in the storage tank (refer to storage tank FPT) being recirculated, ensuring that are discharged to drain and pulled into chopper pump. Confirm performance of the chopper pump in breaking up the solids. Observe the recirculated flow in the active storage tank.
- ff. Storage Tank Flow Cycling: Reduce the recirculation period duration and observe the chopper system cycle through the three active tanks and return to the first storage tank. After a full cycle is complete, place one of the active tanks in Maintenance Mode and enable an additional storage tank and observe the chopper system rotate through the cycle through the newly activated tank and skipping the tank in Maintenance Mode.

- gg. Lead Pump Rotation Manual Priority: Initiate rotation of lead pump by reassigning lead. Confirm the new lead pump starts and accelerates and new lag pump decelerates and stops once new lead proves status. Confirm proper and stable control loop response.
- hh. Scheduled Pump Rotation: Revise schedule to create a rotation of the lead pump. Confirm the new lead pump starts and accelerates and new lag pump decelerates and stops once new lead proves status. Confirm proper and stable control loop response.
- ii. Maintenance Mode: Place the currently operating pump in Maintenance Mode and confirm the lag starts then the pump in Maintenance Mode decelerates and stops.
- jj. Lead Pump Failure: Open disconnect to the VFD feeding the lead operating pump. Confirm alarming. Confirm start of the lag pump and resumption of normal loop control. Close disconnect and reset.
- kk. Simulate valve failures. Typically remove or override status indicators or analog feedback
- ll. Simulate Sensor failures. Remove wiring and confirm alarming and response
- mm. Leak Detection: Simulate a leak on the skid by wetting the leak sensor cable. Confirm alarming, the proper indication of leak location, and required response.
- nn. Single source power failure. As necessary switch operating pumps to a single power source. Open the breaker feeding that power source and confirm alarming and the start of the lag pump on the alternat source.
- oo. Tank Remote Input/Ouptut (RIO failure), remove communication then power to the RIO serving the tank. Confirm alarming and response.
- pp. Decon/Sterilization Mode: Place a chopper pump in Maintenance Mode and open disconnect on the power supply. Initiate a decontamination/sterilization cycle. Coordinate with RIID for placing bioindicators prior to the decon process. Confirm the injection of steam and temperature of pump assembly for the stipulated time. Confirm release of the condensate to the EDS drainage system.

### 3. Filtration Skid

- a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, confirm pipe pressure testing, installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, PVTs and sequence prefunctional testing.
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate.
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.

- e. Steady State Test: Before executing testing, observe and record the operating conditions of the filter skid. Confirm acceptable operating status exists.
- f. Sensor calibration tests including temperature, and pressure sensors.
- g. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
- h. Inactive mode: Confirm valve positions during inactive mode.
- i. Normal drainage flow with peak EDS flow and 3% solids injection (Solids to inject shall be coordinated with USAMRIID but generally include animal waste and hair similar to that of USAMRIID research subjects, plastics found in animal toys, paper towels, sponges and 2ml plastic tubes from research labs. Solids for testing shall be of various sizes to confirm the EDS system removes them through filtration and residuals do not foul the EDS skids). Confirm filter flows and pressures and document filter pressure increase as solids are captured.
- j. Maintenance/Cleaning Mode: Confirm filtration of larger particles. Coordinate with RIID for placing self-contained bioindicators (SCBI) in biowells prior to the sterilization and maintenance process. Establish the materials, protocols, and acceptance criteria for sterilization. Assign filter in Maintenance Mode. Confirm isolation of the filter from effluent drainage flow. Initiate sterilization and confirm sterilization process. Prove 6 log 10 reduction in biological contaminants. Remove solids and clean strainer. Restore filter to normal operation.
- k. Valve failures. Typically remove or override status indicators or analog feedback
- l. Sensor failures. Remove wiring and confirm alarming and response
- m. Leak Detection: Simulate a leak on the skid by wetting the leak sensor cable. Confirm alarming, the proper indication of leak location, and required response.
- n. PLC or RIO failures.
- o. Confirm cycle reporting, data storage and report output.
- p. Decon/Sterilization Mode: Isolate filter for maintenance cleaning. Initiate a decontamination/sterilization cycle. Coordinate with RIID for placing self-contained bioindicators (SCBI) in biowells prior to the decon process. Confirm the injection of steam and temperature of pump assembly for the stipulated time. Confirm release of the condensate to the EDS drainage system.

#### 4. EDS Feed Pumps

- a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, confirm pipe pressure testing, installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, VFD startup, TAB, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.

- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate. Confirm VFD graphic and integrated points
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Steady State Test: Before executing testing, observe and record the operating conditions of the pumps. Confirm acceptable operating status exists.
- f. Sensor calibration tests including pressure sensors and flow sensors.
- g. Valve operational checks: Check open position and status and closed position and status and feedback on analog valves.
- h. Off Mode Disable feed pumps and confirm pumps are off, valves position to the correct position, and status correctly shows pumps are off,
- i. VFD Hand Operation: Confirm the ability to run pumps in HAND and vary speed.
- j. Assign Mag Pumps as lead pump type.
- k. EDS Start: With VFDs in Auto, enable the feed pump system and confirm proper start of lead pump, valve positioning, pump acceleration to control loop setpoint, stage up of required pumps, stable control at setpoint.
- l. Normal Low Flow Mode: confirm operation of the assigned lead pump. Confirm flow through active storage tanks. Record electrical parameters with pump operating at flow setpoint. Verify flow and pressure through EDS skids active at low flow setpoint. Spot check pump vibration. Vary setpoint for control loop to increase capacity and confirm stable response. Confirm check valve isolates flow through lag pumps
- m. Normal High Flow Mode: confirm operation of the assigned lead and lag pumps. Confirm flow through active storage tanks. Record electrical parameters with pump operating at peak setpoint. Confirm pump capacity and speed at peak operating condition. Verify flow and pressure through EDS skids. Spot check pump vibration. Vary setpoint for control loop to reduce capacity and confirm stable response. Confirm check valve isolates flow through lag pumps
- n. Lead Pump Rotation Manual Priority: Initiate rotation of lead pump by reassigning lead. Confirm the next pump in priority starts and accelerates and new lag pump decelerates and stops once new lead proves status. Confirm proper and stable control loop response.
- o. Scheduled Pump Rotation: Revise schedule to create a rotation of the lead pump. Confirm the new lead pump starts and accelerates and new lag pump decelerates and stops once new lead proves status. Confirm proper and stable control loop response.
- p. Lead Pump Failure: Open disconnect to the VFD feeding the lead operating pump. Confirm alarming. Confirm start of the next lag pump and resumption of normal loop control. Close disconnect and reset.



- q. Lead Pump Type Stage Up: Ensure sufficient storage in the storage tanks. Stage up to 3 EDS tanks operating to cause a stage up of the feed pumps. Confirm that the lag pump of the lead type starts, accelerates and the flow control loop responds in a stable fashion to run both feed pumps at a common speed to maintain the required EDS flow of all three EDS skids.
- r. Lead Pump Type Stage Down: Stage down from 3 EDS skids to 2 to initiate a stage down of the lag feed pump. Observe the lag pump decelerate and stop and ensure the control loop responds in a stable fashion to maintain required flow rate in the two operating EDS skids.
- s. System Stop: Disable EDS feed system. Confirm pumps decelerate and stop and correct status is indicated.
- t. Assign seal pumps as lead and repeat tests indicated above for mag pumps.
- u. Simulate valve failures. Typically remove or override status indicators or analog feedback
- v. Simulate Sensor failures. Remove wiring and confirm alarming and response
- w. Since source power failure. As necessary switch operating pumps to a single power source. Open the breaker feeding that power source and confirm alarming and the start of the pump lag pump on the alternat source.
- x. Tank Remote Input/Output (RIO failure), remove communication then power to the RIO serving the tank. Confirm alarming and response.
- y. Maintenance Mode: Place the currently operating pump in Maintenance Mode and confirm the lag starts then the pump in Maintenance Mode decelerates and stops.
- z. Decon/Sterilization Mode: Place a feed pump in Maintenance Mode and open disconnect on the power supply. Initiate a decontamination/sterilization cycle. Coordinate with RIID for placing self-contained bioindicators (SCBI) in biowells prior to the decon process. Confirm the injection of steam and temperature of pump assembly for the stipulated time. Confirm release of the condensate to the EDS drainage system.
- aa. With system operating normally, open disconnect powering the skid. Confirm loss of power alarm and expected response. Close the disconnect and confirm automatic restart of skid process.

## 5. EDS Skid

- a. Prerequisite documentation checks. Review factory acceptance testing reports, confirm weld inspection and testing documents, confirm pipe pressure testing, installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, VFD startup, TAB, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.

- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate.
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Steady State Test: Before executing testing, observe and record the operating conditions of the skids. Confirm acceptable operating status exists.
- f. Sensor calibration tests including biowaste flow, temperature, and pressure sensors
- g. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
- h. EDS Start: Initiate a start of the EDS. Confirm prestart checks, start of the economizer system, preheat of the steam heat exchanger, opening of the effluent flow valve, and the response of all temperature and flow control loops upon startup.
- i. Normal Low Flow Mode and recirculation to storage tanks. Record effluent flow. Record EDS temperatures at each stage. Confirm control of steam heating loop and retention times. Confirm control of the economizer loop and record temperatures entering and leaving both the preheating and cooling heat exchangers.
- j. Normal High Flow with Peak Drainage flow and Recirculation to Storage Tanks. Record effluent flow. Verify economizer pump capacity. Record EDS temperatures at each stage. Confirm control of steam heating loop and retention times. Confirm control of the economizer loop and record temperatures entering and leaving both the preheating and cooling heat exchangers.
- k. Validation: Test performed by EDS vendor with CxC and Government witnessing. Configure bioindicator in wells or dose dosing tank with bioindicator suspension. Initiate process to ensure retention time only heating of bioindicator as applicable. Confirmation of spore 6 log 10 reduction in biological contaminants.
- l. Economizer Pump Failures and Sparger Performance: Place operating economizer pump in the OFF position. Confirm failure enunciation and skid response. Anticipated response is that the skid will continue operation even though the leaving temperature is high. This will cause the sparger to inject cool water to reduce the drain temperature. Confirm response. Reset and clear alarms.
- m. Flow Meter Failure: Remove power from flow meter and confirm alarming and response
- n. Retention Outlet Temperature Sensor Alarm: With the skid operating normally, change the alarm setpoints to initiate high and low alarms. The expected response on a high temperature alarm is that the skid will continue operating and enunciate an alarm. The expected response on low temperature of both sensors, the skid will be failed and locked out. Confirm alarming and response.
- o. Economizer Loop Loss of Pressure: Simulate loss of static pressure of the economizer system which would be indicative of a leak. Expected result is that this will be an alarm only and skid operation will continue and possibly the sparger will activate. Confirm alarming and response.

- p. Steam Valve Failure: Override closed the heating steam valve. The expected response will be that the skid will fail and lock out. Confirm alarming and response.
- q. Retention Sensor Failure: Fail one of the redundant temperature sensors on the retention tube outlet. Anticipated response is that the skid will continue operating and use the remaining sensor for the control loop. Confirm alarming and control loop adjustment
- r. Two Retention Sensor Failures: Fail both of the redundant temperature sensors on the retention tube outlet. Expected response is that the skid will fail and lock out. Confirm alarming and response. Acknowledge alarms and reset.
- s. Loss of Steam Pressure: Throttle steam supply isolation valve to reduce the available steam capacity. Confirm alarming of low temperature and/or steam pressure and required response.
- t. Leak Detection: Simulate a leak on the skid by wetting the leak sensor cable. Anticipated response is that the skid will be locked out. Confirm alarming, the proper indication of leak location, and required response.
- u. Inlet Valve Failures: Simulate the failure of the effluent inlet valve by jumping the closed contact. Anticipated response is that the skid will be failed and locked out. Confirm alarming and response. Return sensor to normal. Acknowledge alarm and reset.
- v. Leaving Sensor Failures. Remove wiring and confirm alarming and response. Anticipated response is that the skid will continue operation.
- w. Inactive/Off Mode: Disable the EDS skid. Observe the skid isolate the effluent flow, close the steam valve, and deenergize the economizer pumps.
- x. Maintenance/Steam Deon Mode: Loading prior to maintenance mode testing will be required to establish the materials, protocols, and acceptance criteria. Isolate the skid, Load with spores/bioindicators in inlet piping. Initiate sterilization mode. Observe steam sterilization, cooldown and HEPA vent release, and solids cleanout.
- y. Local PLC failures. Fail the local PLC and confirm alarming
- z. Power Failure: Open breaker supplying power to the skid. Anticipated response is that the skid run command will be removed and it will alarm. Close breaker to repower the skid. Anticipated response is that the ICS will restart the skid and return it to normal operation. Confirm alarming and reset
- aa. Confirm cycle reporting, data storage and report output.

6. Clean in Place/Neutralization Skid

- a. Prerequisite documentation checks. Review factory acceptance testing reports, confirm installation verification, pressure testing, point to point checks of the PLC I/O, valve checkout, sensor calibration, VFD startup, TAB, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details. Verify safe access to bring in and supply chemicals.

- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
  - d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
  - e. Sensor calibration tests including level, temperature, pH, and pressure sensors.
  - f. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
  - g. EDS Cleaning Cycle with Isolated EDS. Execute a full cleaning cycle
  - h. Neutralization Mode and pump-out. Execute neutralization mode and tank pump out.
  - i. Pump failures: Simulate pump failures and confirm alarming and response. Acknowledge alarms and reset.
  - j. Sensor failures. Simulate sensor failures and confirm alarming and response. Acknowledge alarms and reset.
  - k. PLC/RIO failures and active failover.
  - l. Power Failure: with system in cleaning mode, open breaker serving the CIP skid. Confirm alarming and response. Close breaker and confirm resumption of cleaning cycle.
  - m. Confirm cycle reporting, data storage and report output.
7. Domestic Water:
- a. Prerequisite documentation checks. Confirm installation verification, pressure testing, PRV certification, valve checkout, sensor calibration, and disinfection reports for potable water.
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details. Verify safe access to bring in and supply chemicals.
  - c. Cold Water flow: open fixtures and produce a flow rate through the cold water system near design. Check pressures throughout cold water system and verify sufficient pressure at remote fixtures/flush valves.
  - d. Hot Water System: open fixtures and produce a flow rate through the hot water system near design. Check pressures throughout hot water system and verify sufficient pressure at remote fixtures.
8. Spill Containment:
- a. Prerequisite documentation checks. Confirm installation verification, pipe pressure testing, leak sensor startup, valve checkout, sensor calibration, sequence prefunctional testing.

- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details. Verify safe access to bring in and supply chemicals.
  - c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
  - d. Leak Detection: Simulate a leak on each containment basin (storage tanks, storage tanks, CIP, EDS skid) by wetting the leak sensor cable. Confirm alarming, the proper indication of leak location, and required response.
  - e. Block drains and fill each spill containment basin and monitor levels to confirm no leakage
  - f. Verify level sensors and alarming
  - g. Pump-Out Cycle: Open drains to allow water to drain to containment sump. Confirm lead sump pump starts and lifts the condensate into the storage tank.
  - h. Lead Pump Fail: During pump out cycle, fail the lead pump by turning the HOA switch to OFF. Confirm lag starts and continues to lift the water. Confirm alarming and response. Return HOA to Auto.
  - i. Lead Alternation: Refill tank to restart a pump out cycle. Confirm the lead pump alternates on each cycle start.
9. Water Softener
- a. Prerequisite documentation checks. Review and confirm pipe pressure testing, installation verification, softener startup and recording of recommended cycle times, PVTs and endurance tests.
  - b. Installation inspection and confirmation of access and servicing requirements. Review against design documents, submittals, and details. Verify safe access to bring in and supply chemicals.
  - c. Review manufacturer startup to confirm scheduling and sequence of backwash, rinsing and regeneration cycles.
  - d. Steady State Test: Before executing testing, observe and record the operating conditions of the softeners. Confirm acceptable operating status exists.
  - e. Place load on softener and record system pressures.
  - f. Place unit in bypass
  - g. Initiate a backwash cycle and confirm proper drainage of backwash without wetting floor surface.
  - h. Initiate a rinse cycle for the required duration.
  - i. Initiate a brine refill cycle.

10. Biowaste Drainage and Vent and Steam Systems

- a. Conduct test after all pump, filtration skids, EDS skids, storage tanks, and steam and condensate FPTs are completed and passed.
- b. Ensure BSL-3 and 4 spaces are operating at upper range of negative pressure.
- c. Peak Load Simulation: Put one filtration skid in maintenance mode and one EDS skid in maintenance Mode. Gradually open steam supply and perform manual warm up as the pressure is gradually increased and condensate is returned to the central utility plant. Enable EDS system.
- d. Initiate peak drainage flow into biowaste system from BSL-3 and BSL-4 spaces using available hoses.
- e. Verify ability to segregate effluent flows from A/BSL-3 and A/BSL-4 spaces
- f. System Start: Upon increase in level in the storage tanks, confirm the start of the chopper pump, feed pumps, and two EDS skids to initiate effluent decontamination with flow through two filtration skids.
- g. Inject solids into Storage Tanks. Solids to inject shall be coordinated with USAMRIID but generally include animal waste and hair similar to that of USAMRIID research subjects, plastics found in animal toys, paper towels, sponges and 2ml plastic tubes from research labs. Volume of solids shall be 3% of peak effluent flow. Solids for testing shall be of various sizes to confirm the EDS system removes them through filtration and residuals do not foul the EDS skids). Confirm flows, temperatures, pressures, and retention time on the EDS skid. Open skids and inspect to confirm there is no evidence of solids fouling the tubes.
- h. Observe chopper pump recirculation cycle through active tanks and confirm proper sequence.
- i. Confirm HEPA vent operation and pressures on active storage tanks.
- j. Remove all skids from maintenance mode and ensure they are in lag or standby mode.
- k. Filtration Unit Rotation: with flows still at peak, manually rotate the priority lineup of the EDS skids and confirm proper rotation including start of new lead before new standby stops. Then modify the rotation schedule to initiate a scheduled rotation and confirm proper rotation.
- l. EDS Rotation: with flows still at peak, manually rotate the priority lineup of the EDS skids and confirm proper rotation including start of new lead before new standby stops. Then modify the rotation schedule to initiate a scheduled rotation and confirm proper rotation.
- m. EDS Skid Stage Down: If staging down to a single EDS skid at low flows is included in sequence, reduce flow into the system to low flows and confirm the proper stage down to a single lead EDS skid. Confirm the proper shutoff of the lag and response of the lead..
- n. EDS Skid Stage Up: If staging up to two EDS skids upon increase of flows is included in sequence, increase flow into the system to higher flows and confirm the proper stage

- up to lead and lag EDS skids. Confirm the proper startup of the lag and response of the lead.
- o. Simulate failure or maintenance of a single substation by opening the breaker feeding the distribution panel. Select the substation for deenergization with the most equipment operating. Confirm indication of loss of power and the start of equipment on the remaining live power source. After new systems start and control loops stabilize, close the disconnect to power all equipment. Confirm system returns to equipment prioritization that existed at the outage and lag/standby equipment is staged down.
  - p. Simulate a PLC controller failure and confirm active failover.
  - q. Operate system until storage is reduced to normal levels.
  - r. Produce trend graphics of all system operation throughout test and include in test report including tank levels, chopper pump control loop output and pump speeds, chopper pump recirculation flow, filter skid differential pressure, feed pump control loop output, feed pump status, feed pump speed, feed pump flow, EDS skid flow, economizer pump speed and status, all EDS temperatures and pressures.

#### H10 5.3 HVAC FPTs

##### 1. Steam System and Pressure Powered Pumps

- a. Prerequisite documentation checks. Confirm weld inspection and testing documents, confirm pipe pressure teting, installation verification, point to point checks of the DDC I/O, valve checkout, sensor calibration, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Sensor calibration tests including temperature and pressure sensors
- f. Confirm rating of both medium and low pressure relief valves. Confirm slope of discharge piping and configuration of the drip pan at base of relief riser.
- g. System Warmup: with cool system and steam supply isolated, initiate system warmup by slowly opening the OS&Y dual valves to admit steam into supply headers. Observe slow pressure increase and drainage and lift of the pressure powered condensate pumps. Confirm no steam or condensate piping hammer. Once pressures increase and condensate is drained, open supply valves.
- h. Steady State Test: Before executing testing, observe and record the operating conditions of the steam system. Confirm acceptable operating status exists.

- i. PRV operational checks:
    - i. Starting with little load, confirm control of the 1/3 PRVs for high to medium and medium to low pressure PRVs and the resulting downstream pressure (~63 psig for medium pressure and 18 psig for low pressure. Confirm 2/3 PRVs are closed
    - ii. Increase load using EDS skids for medium pressure and heat loads for low pressure. Confirm 1/3 PRV modulates to maintain pressure until it is fully open. As pressure discharge falls to 60 psig for medium pressure and 15 psig for low pressure, 2/3 PRV modulates open to maintain downstream pressure at setpoint.
    - iii. Close isolation valves upstream of the PRVs and slowly open the bypass valve to confirm adjustment to maintain downstream pressure. Once confirmed, open PRV valves and close bypass valve.
    - iv. Reduce steam loads to observe the 2/3 PRV modulate closed and 1/3 PRV begin to modulate to maintain pressure.
  - j. Observe each pressure powered condensate pump fill and pump out cycles. Confirm drainage back to CRUs
  - k. Produce pressure sensor trends during tests and included in report.
2. Condensate Return Unit
- a. Prerequisite documentation checks. Confirm weld inspection and testing documents for inlet and discharge condensate piping, confirm pipe pressure testing, installation verification, CRU alarm checks of the DDC I/O, valve checkout, sensor calibration, CRU startup documents, PVTs, sequence prefunctional testing, and endurance testing documents
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
  - c. Confirm level switch calibration by observing lead pump start as tank fills, then placing lead pump HOA switch to OFF and observing lag pump start. Return lead pump to AUTO and observe the lag pump shut off then lead pump shut off.
  - d. Confirm normal operation. Observe lead pump start a low start level then it stop at low stop level. Observe pump alternation on each lead pump cycle.
  - e. During operation of the lead pump confirm discharge pressure and confirm it is sufficient for the pumped condensate return to the central utility plant.
  - f. Place current lead pump HOA in OFF and observe level increase to high level start. Observe lag pump stop when level drops. Return pump HOA to AUTO.
  - g. Confirm CRU alarm when each commanded pump fails status. Confirm enunciation of alarm at either PLC or DDC HMI as applicable.
  - h. Confirm High level alarms with both pumps failed.



- i. Place pumps in HAND and confirm Low level alarms then return pumps to AUTO.
  - j. Simulate power failure then restore and confirm resumption of normal sequence.
  - k. Simulate deenergization for service of the priority substation powering the CRU. Confirm expected response.
3. Heating Hot Water System
- a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, pipe pressure testing, installation verification, point to point checks of the DDC I/O, valve checkout, sensor calibration, VFD and pump startup, TAB report, PVTs, sequence prefunctional testing, and endurance testing documents
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
  - c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
  - d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
  - e. Steady State Test: Before executing testing, observe and record the operating conditions of the HW system. Confirm acceptable operating status exists.
  - f. Sensor calibration tests including temperature and pressure sensors
  - g. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
  - h. TAB verification witness: Witness TAB verification per the specifications.
  - i. System off mode: Disable system and confirm the pumps are off and valves are closed as required
  - j. System startup: Enable system and confirm startup process. Confirm lead pump is started and begins to accelerate and proves operation (verify current switch or transducer proof adjustment), lead heat exchanger flow isolation valve opens and proves open, leaving HW control loop enables and begins opening the steam 1/3 valve first to start the heating loop, pump control loop accelerates to begin controlling to DP setpoint in a stable fashion, leaving HW temperature control loop modulates the 1/3 and 2/3 (1/3 Valve opens first, 2/3 valve opens as 1/3 valve approaches 100% open) in series to maintain the HWS setpoint in a stable fashion.
  - k. Load Increase: If load is not already on the HW system, command open the preheat coil and some reheats to increase flow.
  - l. System HW DP control: Confirm a stable DP control on the pressure increase.
  - m. HW Supply temperature control (steam modulation in HX): Confirm a stable temperature control on the lead HX in response to the load increase.

- n. Peak flow condition: Open all valves to obtain the peak flow condition. Confirm the capacity of the lead pump.
- o. Load Decrease to Minimum: Close all coil heating valves. Confirm remote bypass valve modulates to maintain minimum flow condition in a stable fashion. Confirm the DP control loop reduces pump speed in a stable fashion.
- p. Safety trips (High HWS Switch): Override the steam valve control loop to increase the HW supply temperature above the high limit switch setpoint. Confirm the limit switch trips. Confirm alarm enunciation and that the lead HX is commanded off and the lag HX is commanded on. Release override and reset alarm. Confirm lead HX restarts and lag HX stops.
- q. Pump Rotation (Manual): Manually reassign the current lag pump as lead. Confirm the new lead starts and accelerates. Once the new lead pump proves, the new lag pump decelerates and stops. Confirm stable response of the DP control loop.
- r. Pump Rotation (Scheduled): Revise schedule to initiate a scheduled pump rotation. Confirm the new lead starts and accelerates. Once the new lead pump proves, the new lag pump decelerates and stops. Confirm stable response of the DP control loop.
- s. HX Rotation (Manual): Manually reassign the current lag HX as lead. Confirm the new lead HX valve opens and the leaving supply water temperature control loop starts in a stable fashion. Confirm the new lag HX steam valves close and the flow isolation valve closes.
- t. HX Rotation (Scheduled): Revise the schedule to initiate a scheduled rotation of the HX. Confirm the new lead HX valve opens and the leaving supply water temperature control loop starts in a stable fashion. Confirm the new lag HX steam valves close and the flow isolation valve closes.
- u. Pump Failure: Open the disconnect to the operating lead pump. Confirm the lead pump is assessed as failed and alarm is enunciated. Confirm the lag pump starts and accelerates and the DP control loop responds in a stable fashion.
- v. HX Failure: Override the steam valves to the operating heat exchanger closed. Confirm that after the stipulated delay, the low HWS temperature leaving the HX causes the HX to be assessed as failed and an alarm enunciates. Confirm the standby HX is started and the HW isolation valve to the failed HX is closed. Remove override, acknowledge alarms and reset. Confirm the lead HX is commanded to start and the lag is commanded OFF.
- w. HWS Sensor failures: Simulate the failure of the active HWS temperature sensor. Confirm alarm enunciation and specified response. Return sensor to operation, acknowledge alarms and reset.
- x. HW DP Sensor Failure: Simulate the failure of the remote DP sensor. Confirm alarm enunciation and the control loop remains in its last command. Return sensor to operation, acknowledge alarms and reset.
- y. Power Failure: Simulate a power failure to the system by opening the breakers on the substations feeding the distribution panels. Confirm power loss alarm. Close the breaker and confirm the system restarts normally.

- z. Single Substation Power Failure: Open the breaker at the substation feeding the distribution panel that feeds the currently operating pump. Confirm the loss of power alarm. Confirm the lag pump is commanded to start, it accelerates and resumes the DP control loop. Close the breaker and confirm the system returns to the originally operating condition.
  - aa. Controller Loss of Communication: Unplug the cat6 cable to the HW system controller. Confirm the controller continues to execute the HW sequences using the last value of the DP sensor or any other network values. Confirm loss of communication alarm at the HMI. Re
  - bb. Controller Failure: Remove power to the HW system controller. Confirm the HW system stops. Confirm the loss of communication alarm at the HMI. Restore power and confirm the system restarts per the system start sequence.
4. CHW System
- a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, pipe pressure testing, installation verification, point to point checks of the DDC I/O, valve checkout, sensor calibration, TAB report, PVTs, sequence prefunctional testing, and endurance testing documents
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
  - c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
  - d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
  - e. Steady State Test: Before executing testing, observe and record the operating conditions of the CHW system. Confirm acceptable operating status exists.
  - f. Sensor calibration tests including temperature and pressure sensors
  - g. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
  - h. TAB verification witness: Witness TAB verification per the specifications.
  - i. Peak Flow Condition: Confirm peak CHW flow with peak condition on all CHW coils by overriding open the CHW valves. Record pressures and confirm required flows.
5. AHUs
- a. Prerequisite documentation checks: review and confirm duct leak testing, installation verification, point to point checks of the DDC I/O, valve and damper checkout, sensor calibration, AHU startup, VFD startup, heat recovery wheel startup, TAB report, PVTs, sequence prefunctional testing, and endurance testing documents

- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate
- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Steady State Test: Before executing testing, observe and record the operating conditions of the AHU. Confirm acceptable operating status exists.
- f. Sensor calibration tests including temperature and pressure sensors
- g. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
- h. Damper Operational Checks: Check open position and status and closed position and status. Confirm dampers seal acceptably while closed.
- i. TAB verification witness: Witness TAB verification per the specifications.
- j. Safety trips: Trip the safety devices to confirm alarm and specified response including:
  - i. Freezestat by placing the tube in ice water
  - ii. High and low pressure switch trip using the hand bulb or pressure pump to change pressure beyond trip point
  - iii. Duct smoke detectors using smoke simulation/tester
- k. System Off Mode: Disable the system and confirm AHUs are both off, OA dampers are closed, preheat recirc pump is OFF, and heating and cooling valves are closed
- l. VFD HOA: Confirm operation of VFD in HAND, OFF, and AUTO. Confirm out of auto alarms
- m. AHU System Start: Enable the supply air system. Confirm
  - i. OA Damper is commanded to open and proves open
  - ii. Supply fan is started and accelerates and proves status (verify current switch or transducer proof adjustment)
  - iii. Duct static control loop starts to control fan speed to maintain the duct static pressure setpoint
  - iv. Discharge air temperature control loop starts control of the preheat or cooling valve based on OA temperature
  - v. Heat pipe is controlled based on OA temperature.

- n. Supply Fan duct static pressure control and peak flow capacity and loaded filters: Confirm the supply duct static control loop controls to the duct pressure setpoint. Reduce the setpoint to confirm a stable response. Return setpoint to that established by TAB contractor and confirm a stable response.
- o. Peak Airflow Control: Confirm all supply air VAV boxes are controlling to their design setpoint. Simulate a loaded filter by blocking areas of the clean filters with cardboard to create loaded DP. Confirm the capacity of the fan to maintain static setpoint at peak flow conditions.
- p. Optimal Static Pressure Setpoint: Confirm VAV box position at most remote VAV box is above 90% but controlling to design CFM.
- q. Loaded Filter Alarms: Increase the filter DP above loaded setpoint either using cardboard or a hand bulb to simulate a high pressure across the filter. Confirm the alarm enunciation. Acknowledge alarm and return to normal.
- r. Fan Vibration Check: Spot check vibration of fan and motor bearings and confirm vibration is acceptable per vibration severity chart. Also confirm the vibration isolation devices are free floating.
- s. Summer discharge air temperature control mode: With OA temperatures above 80°F, confirm the control of the discharge temperature by both control of heat pipe and modulation of the CHW valve. Reduce supply air temperature setpoint and confirm stable response. Return to design setpoint and confirm stable response. Confirm the preheat valve remains closed and preheat pump remains off. In the absence of high outside air temperatures during testing, verify cooling coil capacity by overriding open the preheat coil to add sensible heat to the entering temperature.
- t. Mild OA discharge air temperature control mode: With OA temperature between 55°F and 80°F, confirm the heat pipe with bypass is controlled to minimize heat exchange, and CHW valve modulates to maintain discharge air temperature setpoint. Confirm the preheat valve is closed and the preheat pump is off.
- u. Cool OA discharge air temperature control mode: With OA between 35°F and 55°F, confirm the heat pipe controls to supply air temperature setpoint. Confirm the preheat valve remains closed and preheat pump remains off.
- v. Cold OA discharge air temperature control mode: Confirm that with heat pipe at full recovery and supply air temperature below setpoint, the preheat valve begins to modulate open and the preheat recirculation pump is commanded to start and starts and proves. Confirm the preheat valve modulates to maintain the discharge air temperature setpoint in a stable fashion. As OA temperature falls below 15 °F, confirm bypass valve controls to prohibit frost conditions on exhaust section.
- w. Heat Pipe Failure: During cold OA mode, simulate a failure of the heat pipe. Confirm alarm enunciation and that the preheat controls to maintain discharge air temperature setpoint.
- x. Fan Failure: Open the breaker serving the VFD to simulate a fan failure. Confirm alarm enunciation, removal of the run command, command for lag AHU to start, failed unit going to the off position, and proper startup of the lag AHU.

- y. Supply Air Sensor failures: Simulate the failure of the supply air temperature sensor. Confirm alarming and expected response (temperature control loops remain last). Restore sensor and acknowledge alarms. Confirm temperature control loops resume normally.
- z. Static Pressure Sensor Failure: Simulate the failure of the static pressure sensor. Confirm alarming and expected response (fan speed remains at the last value before failure). Restore sensor and acknowledge alarms. Confirm fan speed control loop resumes normally.
- aa. Supply Temperature High and Low Alarms: Simulate high and low alarms by changing the alarm point to lower or higher than the current temperature. Confirm alarming and enunciation. Reset alarm setpoint.
- bb. HW Valve failures: Simulate HW valve failure by removing the feedback wiring. Confirm alarming and enunciation and restore feedback wiring.
- cc. CHW Valve failures: Simulate CHW valve failure by removing the feedback wiring. Confirm alarming and enunciation and restore feedback wiring.
- dd. OA Damper Failures: Simulate the failure of the OA damper to open by disconnecting the open status relay. Confirm the alarming and enunciation and confirm the AHU run command is removed.
- ee. Exhaust System Failure: Simulate a low exhaust static pressure by tripping the exhaust pressure switch. Confirm alarming and enunciation and confirm the AHU run command is removed.
- ff. Power Failure: Simulate a loss of power to the AHU by opening the breaker feeding the VFD. Confirm alarming and enunciation of the loss of power. Acknowledge alarm then close the breaker. Confirm the AHU restarts per start sequence.
- gg. Controller Loss of Communication: Unplug the cat6 cable to the AHU system controller. Confirm the controller continues to execute the AHU sequences using the last value of the static sensor or any other network values. Confirm loss of communication alarm at the HMI. Plug the cable back in.
- hh. Controller Failure: Remove power to the AHU system controller. Confirm the AHU stops. Confirm the loss of communication alarm at the HMI. Restore power and confirm the system restarts per the system start sequence.

## 6. Exhaust Air System

- a. Prerequisite documentation checks: review and confirm duct leak testing, installation verification, point to point checks of the DDC I/O, damper checkout, sensor calibration, exhaust fan startup, VFD startup, HEPA Filter certification, TAB report, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic representations are accurate

- d. Trend Configuration: confirm the point trends have been set up by change of value or time increments as directed by USAMRIID. Review trend period trends to confirm stable operation in acceptable ranges.
- e. Steady State Test: Before executing testing, observe and record the operating conditions of the Exhaust air system. Confirm acceptable operating status exists.
- f. Sensor calibration tests including temperature and differential/static pressure sensors
- g. Damper Operational Checks: Check open position and status and closed position and status. Confirm dampers seal acceptably while closed.
- h. Bubble Tight Damper Operational Checks: Check the open position and status and closed position and status of automated bubble tight dampers.
- i. TAB verification witness: Witness TAB verification per the specifications.
- j. Exhaust Low Pressure Switch: Confirm the setting and action of the low exhaust duct static pressure switch (anticipated to be used to shut down supply system upon lack of exhaust pressure).
- k. System Off Mode: Disable the system. Ensure the fans are off, and dampers close per the sequence. Confirm the supply air system stops when there is no exhaust fan status or inadequate pressure in the exhaust duct.
- l. Exhaust System Start: Enable the exhaust system. Confirm the blade and bubble tight dampers open for normal operation. Confirm the lead exhaust fan is commanded to start and it starts and accelerates then proves operation (verify current switch or transducer proof adjustment). Observe the duct static pressure control loop adjust the fan speed to maintain the exhaust duct static pressure setpoint and it performs in a stable fashion
- m. Exhaust Fan duct static pressure control and peak flow capacity with loaded HEPA filter: Confirm fan capacity at peak flow condition. Adjust manual bubble dampers on HEPA filter to simulate loaded HEPA filter.
- n. Loaded HEPA Filter Alarm: Increase differential pressure across HEPA filter above the loaded filter pressure alarm.
- o. Optimal Static Pressure Setpoint: Confirm VAV box position at most remote VAV box is above 90% but controlling to design CFM.
- p. HEPA Filter Bypass: Open HEPA filter bypass duct and isolate the HEPA filter for decontamination. Confirm the flow control of the VAV boxes and the response of the static pressure control loop respond in a stable fashion.
- q. Exhaust Fan Rotation (Manual): Manually reassign the lead exhaust fan. Confirm the new lead is commanded to start and accelerates to jog speed, the damper is commanded to open, the new lead fan accelerates to the static pressure control loop, the new lag is commanded off and decelerates to minimum speed, the new lag isolation damper closes, and the new lag fan stops. Confirm the spaces maintain the direction airflow throughout this test.

- r. Exhaust Fan Rotation (Scheduled): Adjust schedule to initiate a scheduled rotation of the lead exhaust fan. Confirm the new lead is commanded to start and accelerates to jog speed, the damper is commanded open, the new lead fan accelerates to the static pressure control loop speed, the new lag is commanded off and decelerates to minimum speed, the new lag isolation damper closes, and the new lag fan stops. Confirm the spaces maintain the direction airflow throughout this test.
- s. Fan Maintenance Mode: Place the lead exhaust fan into Maintenance Mode. Confirm the new lead is commanded to start and accelerates to jog speed, the damper is commanded open, the new lead fan accelerates to the static pressure control loop speed, the new lag is commanded off and decelerates to minimum speed, the new lag isolation damper closes, and the new lag fan stops. Confirm the spaces maintain the direction airflow throughout this test. Remove fan from Maintenance Mode and confirm specified response.
- t. Lead Exhaust Fan Failure (also single source power loss): Simulate a lead exhaust fan failure by opening the breaker feeding the VFD. Confirm status is lost and as fan decelerates the exhaust duct static pressure falls below the trip point and the AHU run command is removed, the fan is assessed as failed, failure alarm enunciates, lag/standby fan is commanded to start, it accelerates to jog speed, damper is commanded open and proves open, fan accelerates to speed required to maintain duct static pressure setpoint. Confirm AHU is commanded to restart once the exhaust static pressure exceeds low static pressure setpoint. Confirm the directional airflow in rooms and at containment zone does not reverse. Close the opened breaker, acknowledge alarm, and confirm the specified response.
- u. Duct Static Pressure Sensor Failure: Simulate the failure of the exhaust duct static pressure sensor by removing a wire from the controller input. Confirm alarm and confirm the system continues operation at the last known value. Acknowledge alarm and restore sensor wiring. Confirm the exhaust system resumes normal operation.
- v. Exhaust Fan Isolation Damper Failure: Override closed the isolation damper of the operating exhaust fan. Confirm open status is lost and fan decelerates to jog speed. As fan decelerates and the exhaust duct static pressure falls below the trip point confirm the AHU run command is removed. Confirm that after the applicable time delay, the fan is assessed as failed, failure alarm enunciates, lag/standby fan is commanded to start, it accelerates to jog speed, damper is commanded open and proves open, fan accelerates to speed required to maintain duct static pressure setpoint. Confirm AHU is commanded to restart once the exhaust static pressure exceeds low static pressure setpoint. Confirm the directional airflow in rooms and at containment zone does not reverse. Restore damper, acknowledge alarm, and confirm the specified response.
- w. HEPA Bubble Tight Damper Failure: Simulate the automated bubble tight damper failure by switching into manual operation and closing the damper. Confirm alarm enunciation. As the damper closes and the exhaust static pressure falls to below the trip point, confirm the AHU run command is removed. Confirm the directional airflow in rooms and at containment zone does not reverse.
- x. Controller Loss of Communication: Unplug the cat6 cable to the exhaust system controller. Confirm the controller continues to execute the exhaust sequences using the last value of the static sensor or any other network values. Confirm loss of communication alarm at the HMI. Plug the cable back in and confirm normal operation resumes.



- y. Controller Failure: Remove power to the exhaust system controller. Confirm the exhaust and AHU stop. Confirm the loss of communication alarm at the HMI. Restore power and confirm the system restarts per the system start sequence.

7. Room Temperature and Airflow (For each room based on room with a fan coil unit)

- a. Prerequisite documentation checks: review and confirm duct leak testing, installation verification, point to point checks of the DDC I/O, valve and damper checkout, sensor calibration, VAV box startup, fan coil unit startup, TAB report, PVTs, sequence prefunctional testing, and endurance testing documents
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
- c. Workstation graphic checks. Confirm all required points are properly mapped to the graphics and schematic and floor plan representations are accurate
- d. Steady State Test: Before executing testing, observe and record the operating conditions of the room HVAC. Confirm acceptable operating status exists.
- e. Sensor calibration tests including temperature and room differential pressure sensors
- f. Valve operational checks. Check open position and status and closed position and status and feedback on analog valves
- g. VAV Damper Operational Checks: Command vs feedback position of VAV dampers.
- h. TAB verification witness: Witness TAB verification per the specifications.
- i. Trend Review: Review the two week trend of the room and confirm stable operation at appropriate setpoints
- j. Full Heat Mode: Raise the heating setpoint above the current room temperature. Confirm:
  - i. Exhaust VAV box maintains design flow rate  $\pm 5\%$ . Verify flow accuracy via airflow measurement
  - ii. Supply VAV box maintains TAB determined offset below the exhaust flow rate  $\pm 5\%$ . Verify flow accuracy via airflow measurement
  - iii. VAV box reheat coil opens to heat the supply air. Verify temperature increase above supply air
  - iv. Fan coil unit is commanded on and the heating coil opens to maintain the space temperature setpoint plus offset for fan coil unit
  - v. Room differential pressure indicates proper directional airflow. Smoke test doors to confirm proper directional airflow.
- k. Neutral Mode: Adjust the heating setpoint below the current room temperature and the cooling setpoint above the current room temperature. Confirm:

- i. Exhaust VAV box maintains design flow rate  $\pm 5\%$
- ii. Supply VAV box maintains TAB determined offset below the exhaust flow rate  $\pm 5\%$
- iii. VAV box reheat coil closes initially but may modulate if space temperature falls to heating setpoint.
- iv. Fan coil unit is commanded off
- v. Room differential pressure indicates proper directional airflow
- l. Full Cool Mode: Lower the cooling setpoint below the current room temperature. Confirm:
  - i. Exhaust VAV box maintains design flow rate  $\pm 5\%$
  - ii. Supply VAV box maintains TAB determined offset below the exhaust flow rate  $\pm 5\%$
  - iii. VAV box reheat coil valve closes. Verify reheat valve seals by confirming no temperature rise across coil.
  - iv. Fan coil unit is commanded on and the cooling coil opens to maintain the space temperature setpoint plus offset for fan coil unit
  - v. Room differential pressure indicates proper directional airflow
- m. Temperature Alarms: Change the high and low temperature alarm limits to cause high and low room temperature alarms. Confirm alarming and enunciation. Return alarm limits to original.
- n. FCU Failure: Set room setpoint to require the fan coil unit to operate. Simulate a failure of the fan coil unit by opening the breaker supplying power to it. Confirm alarm enunciation. Return power to unit and acknowledge alarms.
- o. VAV Box Failure: For both the supply and exhaust VAV boxes, remove power from the controller for the zone. Confirm alarming of loss of communications to the controller and confirm the dampers remain in last position. Confirm proper directional airflow. Restore power to controller and confirm the VAV boxes return to normal operation.
- p. Room Differential Pressure Alarms: Override the supply air flow setpoint to above the exhaust volume. Confirm the room differential pressure alarm locally and at the HMI. Release the supply flow control back to normal.
- q. AHU Failure: Configure rooms into peak airflow. Simulate a failure of one of the two running AHUs which are not sized for full redundancy. This will reduce the flow available to some rooms. Document the response of the airflow tracking system and record room differential pressures during this condition.

#### H10 5.4 Control and Automation FPTs

1. EDS Industrial Control System (ICS using PLCs)

- a. Prerequisite documentation checks: review and confirm PLC/RIO startup and addressing, as built/record control drawings. Review all PVTs including cybersecurity PVTs. Confirm compliance with Risk Management Framework.
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
  - i. Inspect all control panels and confirm panels are clean, properly labeled with panel name and power source, dual power supplies are installed and labeled, all components are installed and labeled, wiring run neatly in raceway, network cabling is labeled on both ends of the connection and run neatly in raceway, I/O wiring is labeled run neatly in raceway, I/O points are labeled/identified, panel record drawings are included and accuracy is confirmed by inspection. Pull test I/O terminations. Confirm panel keys have been provided. Confirm enunciation lights, graphic interfaces, buttons and switches are installed and labeled per design requirements and approved submittals.
  - ii. Verify uninterruptible power supply on both sources of power to panels.
  - iii. Inspect head end server, HMI screens, and printers and confirm they are per design requirements and submittals.
- c. Head End Graphics and Configuration checks.
  - i. Confirm access permissions have been configured per USAMRIID direction. Test access to various levels
  - ii. Most graphics are confirmed as part of the FPTs of the systems represented. Confirm the home page screens and navigation to system related screens.
  - iii. Confirm the alarm screens and logs are configured properly and allow filtering, acknowledging alarms, and display alarm levels and status.
  - iv. Confirm output to remote alarm enunciation (phone, text, email, etc.) has been configured per USAMRIID direction. (Refer to Section D40 for BMS remote alarming requirements).
  - v. Output a cycle reports have been configured and formatted per USAMRIID direction
  - vi. Confirm trending screens are configured properly and allow both opening of predefined trends and configuration of custom trends. Confirm trend data has been configured to store in trend database.
  - vii. Confirm programming software is installed with access assigned to proper access levels. Confirm program and configuration files have been backed up and provided to USAMRIID.
- d. Secondary PLC Failure: Remove power to the secondary PLC. Confirm alarm enunciation and continuation of control and monitoring on the primary PLC. Restore power and reset alarms.
- e. Primary PLC Failure: Remove power to the primary PLC. Confirm alarm enunciation and continuation of control and monitoring on the secondary PLC. Restore power to

the primary PLC and reset alarms. Confirm control and monitoring returns to the primary PLC.

- f. Primary PLC Switch: Reassign the secondary PLC as the primary PLC and confirm the control and monitoring switches to the new primary PLC.
  - g. Remote Input Output Failure (RIO): Generally RIO failures are tested with the systems they serve. Confirm proper enunciation of alarm and response to RIO failure.
  - h. Cybersecurity Compliance: Confirm system is not connected to external system and not publicly accessible. Witness EDS cybersecurity PVT for combined PVT/FPT.
2. Building Automation System (BAS using DDC controllers) Extensions
- a. Prerequisite documentation checks: review and confirm controller (unitary, application specific, etc.) startup and addressing, as built/record control drawings
  - b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details.
    - i. Inspect all control panels and confirm panels are clean, properly labeled with panel name and power source, power supplies are installed and labeled, all components are installed and labeled, wiring run neatly in raceway, network cabling is labeled on both ends of the connection and run neatly in raceway, I/O wiring is labeled run neatly in raceway, I/O points are labeled/identified, panel record drawings are included and accuracy is confirmed by inspection. Pull test I/O terminations. Confirm panel keys have been provided. Confirm enunciation lights, graphic interfaces, buttons and switches are installed and labeled per design requirements and approved submittals.
    - ii. Verify uninterruptible power supply on both sources of power to panels.
    - iii. Inspect head end server, HMI screens, and printers and confirm they are per design requirements and submittals.
  - c. Head End Server, Graphics, and Configuration checks.
    - i. Confirm setup of all database and operator server workstations. Confirm installation of all required software and current software upgrades.
    - ii. Confirm access permissions have been assigned to the new system per USAMRIID direction.
    - iii. Most graphics are confirmed as part of the FPTs of the systems represented. Confirm the home page screens navigation to system related screens.
  - d. Anti-Terrorism/Force Protection (AT/FP): Initiate activation of the alarm modes for the AT/FP sequence. Confirm shut down and isolation of the applicable systems. Reset alarm mode and confirm return of systems to normal operation.

**H10 5.5 Electrical FPTs**

**1. Power Distribution**

- a. Prerequisite documentation checks: review and confirm installation verification, termination torque record, NETA testing on breakers, panels, conductors, etc., panel startup, panel schedules (refer to representative 26 08 00 section included in the RFP for NETA testing requirements), and prefunctional checklists
- b. Installation inspection and confirmation of access requirements. Review against design documents, submittals, and details. Deenergize and perform live-dead-live test prior to internal inspection.
- c. Breaker Settings Checks: Review breaker settings and confirm conformance with the Short Circuit and Arc Flash (SCAF) study.
- d. Confirm ability to rack out breakers and restore.
- e. Confirm accuracy of meter readings
- f. Check resistance to ground
- g. Coordinate with NETA testing company and load panels for thermographic survey.

**2. Room Receptacles**

- a. Prerequisite documentation checks: review and confirm installation verification and receptacle checkout, and prefunctional checklist.
- b. Installation inspection. Review against design documents, submittals, and details. Confirm color coding of receptacle plates. Confirm connection to the labeled breaker
- c. Use receptacle tester to test all receptacles including GFI receptacles

**3. Lighting and Lighting Control**

- a. Prerequisite documentation checks: review and confirm installation verification, illumination measurements, lighting control startup, and prefunctional checklist.
- b. Installation inspection. Review against design documents, submittals, and details. Confirm fixtures and lenses are clean
- c. Illumination Levels: Confirm all fixtures and lenses are clean. Spot check illumination levels throughout spaces.
- d. Lighting Control: confirm operation of all light switches, occupancy sensors, and lighting schedules as applicable

**H10 5.5 Fire Protection FPTs**

**1. Fire Alarm System Extensions**

- a. Prerequisite documentation checks: review and confirm installation verification, fire alarm device 100% contractor checkout (smoke and heat detectors, pull stations, flow switches, tamper switches, audio and visual strobes, etc.), Fire Alarm Control Panel startup, and prefunctional checklists.
  - b. Installation inspection. Review against design documents, submittals, and details. Review record drawings and confirm location of all devices and FACP's
  - c. Device Test: Test all devices (smoke detectors (using test smoke), heat detectors, pull stations, flow switches, tamper switches, etc) and verify enunciation and response per Fire Alarm Matrix
  - d. Zone Circuit: Confirm zone notification appliance circuit communications and monitoring. Verify trouble indication.
  - e. Coordinate with sprinkler testing to test flow and tamper switches.
  - f. Fire Alarm Matrix Test: for each type of sensed device, confirm the overall response of the fire alarm system to activate audio and visual horns and strobes as well as mass messaging as defined in the Fire Alarm Matrix. As part of this process, remove utility power to the FACP's and confirm battery capacity.
  - g. Remote Notification: Verify remote notification via wireless connection to the base fire department.
2. Fire Suppression/Sprinkler System
    - a. Prerequisite documentation checks: review and confirm weld inspection and testing documents, pipe pressure testing, sprinkler pipe flushing and cleaning reports, installation verification, tamper and flow device checks, OS&Y valve checkout, sequence and prefunctional testing, endurance testing documents
    - b. Installation inspection. Review against design documents, submittals, and details. Review record drawings and confirm location of all sprinkler zone inspector test stations and sprinkler heads
    - c. Test operation of all OS&Y valves and confirm tamper switch indications
    - d. Use inspector test stations to simulate release in each zone. Verify proper enunciation and response of the Fire Alarm system per the Fire Alarm Matrix.

#### H10 5.6 Security System FPTs

1. Access Control System (Including Duress, Intrusion Detection, and Signage) Additions
  - a. Most devices are existing but will require modification based on door changes. Full door tests shall be conducted after modification on the two doors requiring access control to the EDS area. Tests shall also be conducted on the shower in/out signage.
  - b. Prerequisite documentation checks: review and confirm installation verification, door hardware checkout, security device checkout (card readers with keypads, door position sensors, occupancy/motion sensors, locks, etc.), access control panel startup, permission verifications, and prefunctional checklists.

- c. Installation inspection. Review against design documents, submittals, and details.
  - d. Entry/Exit Permission Granted at all doors: Using a card to which access has been granted, perform entry and exit. Confirm operation of door hardware and locks. Confirm tone indicates access. Verify recording of room access. Confirm adjustment and operation of motion sensor to release locks when approaching the door to exit.
  - e. Door Held Open Alarm: on exiting the room, hold door open until a Door Held Open alarm is enunciated and alarm sounds. Verify recording of alarm.
  - f. Entry/Exit Permission Denied at all doors: Using a card to which access has not been granted, attempt an entry. Confirm door remains locked and permission is not granted. Confirm tone indicates access denied. Verify recording of attempt to access room.
  - g. Intrusion/Door Forced Open Alarm: While closing doors with mag locks, insert obstruction between magnets. Confirm bond sensor indicates door not closed. Open door and verify door forced open alarm.
  - h. Duress Entry: Without access card, enter duress entry key code. Confirm access is granted and alarm is enunciated in security room.
  - i. Shower Change In Use Signage: Verify the three position switch properly enunciates Male, Female, and Off on the signage.
  - j. Fire Alarm Interlock: Initiate a fire alarm to and confirm doors can be opened to egress.
  - k. Power Outage: Remove power to security panel and verify doors can be opened in "fail safe" mode.
2. CCTV System and Two Way Communications Additions
- a. Prerequisite documentation checks: review and confirm installation verification, camera checkout, control workstation checkout, and prefunctional checklists.
  - b. Installation inspection. Review against design documents, submittals, and details.
  - c. Camera Verification: Observe camera image in control room. Verify range of view and focus while zoomed out and then while zoomed in. Pan across range and tilt through heights and confirm camera meets required viewing area. Verify focus with all views.
  - d. Two Way Communications: Initiate communication between room speaker phone and control room. Verify adequate audio and caller ID. During two way communications, confirm the room camera pans and tilts to view the caller.

## H10 6 INTEGRATED SYSTEMS TESTING (IST)

### H10 6.1 IST GENERAL

1. Integrated Systems Testing shall be performed on systems upon successful completion of prerequisite FPTs. CxC shall report completion of required FPTs and distribute FPT documentation. ISTs shall be scheduled with the Government stakeholders

witnessing/participating. CxC or their applicable technical Cx specialist will direct and record the testing. Relevant contractor team members (prime contractor, subcontractors, vendors, TAB, BAS contractors, and those applicable to the system) shall execute the testing using NIST certified instrumentation as required.

2. ISTs shall be coordinated with Government stakeholders (USAMRIID Facilities and Safety, MRDC/USAMRIID, DA Safety) to allow participation and witnessing as desired.
3. Following is a preliminary general list of ISTs to be completed and high-level summaries of the tests to be performed. CxC shall expand on the requirements for ISTs and clearly specify those requirements in the design specifications based on the finally determined system requirements and sequences of operation. CxC shall develop and finalize ISTs under the DB contract. Note that the sequences of operation of the EDS system will be developed by the DB Contract team in concert with the selected EDS vendor. Tests below are speculative and may either not apply or not represent all required tests. Tests listed below shall be performed when applicable to the final sequence of operation. They also establish an expected level of detail to be expanded based on the final sequences.

#### H10 6.1 IST GENERAL

#### H10 6.2 ISTs

1. Process Area Suite Directional Airflow
  - a. Test will be done after all previous HVAC test FPTs are complete. Test will trend all room differential pressures at one second intervals through various system modes of operation. Establish drainage into EDS system and keep the EDS system operating with flow through the EDS skids during these tests.
  - b. Disable all air systems. Confirm the system shut down process maintains the proper directional through the system shut down. Establish room differential pressure trends and include the graphs in the report. Capture graphic images of the disabled system and include in IST report
  - c. Enable air systems and observe the systems start and assume normal control. Confirm proper directional airflow through startup without excessive negative pressure. Include trends of room DPs and images of graphics with system operating normally.
  - d. Simulate leak from storage tanks: discharge water from tanks to the floor. Confirm alarming and return of water to the tank via the sump pump. Confirm HVAC systems continue normally and maintains directional airflow. Perform three change in processes. Initiate two-way communication and confirm camera view of the caller. Pan and tilt camera to view the wetted area. Perform 3 change out processes. Include trends of room DPs and images of graphics with system operating through leakage alarm.
  - e. Fail AHU: Open disconnect serving the AHU VFD. Confirm alarming and confirm the response of the exhaust system.. Acknowledge alarms, restore AHU to operation, reset alarms, and observe the AHU restart and return to normal operation. Include trends of room DPs and images of graphics with system operating during failed AHU then restart.
  - f. Isolate HEPA filters for service: Open bypass damper for exhaust HEPA filter then isolate the HEPA filter for service. Confirm proper directional airflow in the rooms.



Restore the HEPA filter to normal operation and close bypass damper. Include trends of room DPs and images of graphics with system operating with the HEPA filter in maintenance.

- g. Rotate exhaust fan priority: Change the priority of the exhaust fans to cause a rotation. Observe the start of the new lead fan and the stop of the new lag. Confirm proper directional airflow of the rooms during the rotation. Include trends of room DPs and images of graphics with system operating through the rotation.
  - h. Exhaust Fan Failure: Fail one of the operating exhaust fans by opening the disconnect to its respective VFD. Confirm alarming and ramp up of remaining operational fan. Confirm upon loss of pressure in the exhaust system the AHU is commanded off in the event the remaining operational fan loses fan status or cannot maintain adequate duct pressure in the exhaust duct. Confirm proper directional airflow throughout the process and include trends of room DPs and images of graphics through process.
  - i. Exhaust Air System; With one exhaust fan already failed, fail the operating fan by removing power to the VFD thus causing a failure of the exhaust system. Confirm upon loss of pressure in the exhaust duct, the AHU is commanded off and stops. Confirm proper directional airflow until both systems stop. Acknowledge alarms, reset any lockouts, and repower the exhaust fans. Confirm the system starts through the start sequence. Confirm proper directional airflow through the system restart. Include trends of room DPs and images of graphics with system operating through the failure and restart.
- 2. Biowaste Drainage and Vent: and Steam Systems Worst Case Simulation Plus Failures
  - a. Conduct test after all FPTs are completed.
  - b. Establish trends of all room DPs and all EDS system sensors
  - c. Worst Case Simulation: Charge storage tanks to simulate the CUP steam outage maximum storage. Put one filtration skid in maintenance mode and one EDS skid in maintenance Mode.
  - d. Ensure BSL-3 and 4 spaces are operating at upper range of negative pressure.
  - e. Initiate peak drainage flow into biowaste system from BSL-3 and BSL-4 spaces using available hoses and domestic.
  - f. Confirm the storage tank and lift pump operation as the system is restarted.
  - g. Gradually open steam supply and perform manual warm up as the pressure is gradually increased and condensate is returned to the central utility plant. Enable EDS system and observe the start of chopper pump, two feed pumps, and two EDS skids to initiate effluent decontamination with flow through two filtration skids.
  - h. Inject solids in effluent drainage system. Solids to inject shall be coordinated with USAMRIID but generally include animal waste and hair similar to that of USAMRIID research subjects, plastics found in animal toys, paper towels, sponges and 2ml plastic tubes from research labs. Volume of solids shall be 3% of peak effluent flow. Solids for testing shall be of various sizes to confirm the EDS system removes them through filtration and residuals do not foul the EDS skids). Confirm flows, temperatures,

pressures, and retention time on the EDS skid. Open skids and inspect to confirm there is no evidence of solids fouling the tubes.

- i. Observe sweeping pump recirculation cycle through active tanks and confirm proper sequence.
  - j. Confirm HEPA vent operation and pressures on active storage tanks.
  - k. Remove all skids from maintenance mode and ensure they are in lag or standby mode.
  - l. Substation Outage: Simulate failure or maintenance of a single substation by opening the breaker in that substation feeding the distribution panels and ATS. Select the substation/distribution panel for deenergization with the most equipment operating. Confirm indication of loss of power and the start of equipment on the remaining live power source. For systems powered by ATS, confirm ATS switches to the alternate source and fed equipment restarts. After new systems start and control loops stabilize, close the disconnect to power all equipment. Confirm system returns to equipment prioritization that existed at the outage and lag/standby equipment is staged down.
  - m. Simulate a PLC controller failure and confirm active failover.
  - n. Operate system until storage is reduced to normal levels and one storage tank can be put into standby.
  - o. Continue charging drainage system for a minimum of 3 days after the start of the drainage from the full storage tanks.
  - p. Produce trend graphics of all system operation throughout test and include in test report including (tank levels, chopper pump control loop output and pump speeds, chopper pump recirculation flow, filter skid differential pressure, feed pump control loop output, feed pump, status, feed pump speed, feed pump flow, EDS skid flow, economizer pump speed and status, all EDS temperatures and pressures
3. Anti-Terrorism/Force Protection
- a. Conduct test after all FPTs are completed.
  - b. Initiate AT/FP modes as detailed in the final sequences. Confirm alarm enunciation and response of all systems.
  - c. Return systems to normal operation and confirm response.
  - d. Confirm proper directional airflow of the rooms during the AT/FP modes. Include trends of room DPs and images of graphics in IST log.

-End of Section-

SECTION 01 11 00

SUMMARY OF WORK  
08/15, CHG 2: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-02

(2020; with Change 1, 2020) High  
Performance and Sustainable Building  
Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals  
Salvage Plan; G

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Description

The new SSP (Steam Sterilization Plant), shall to be designed, constructed, and commissioned to provide the capability to deactivate all of the liquid waste solely coming from the U.S. Army Research Institute of Infectious Diseases (USAMRIID) Building 8100 located at the Fort Detrick, Maryland army base. The Building B8100 SSP shall be designed to replace the existing Building 8150 function, to provide a new continuous flow effluent decontamination system ('EDS') with all associated utilities, piping, equipment and components necessary. The new EDS system is located at Ground level within the existing non-occupied Room 1SA202. The EDS shall be dedicated to process and deactivate all of the liquid waste coming from Building 8100 (upon completion of construction, commissioning, and CDC certification) for the BSL-3E and BSL-4 Select Agent work within Building 8100, only. The effluent flows shall be decontaminated and released to the Fort Detrick sanitary waste system. To date, Building 8150 is not operational, and therefore has required the government to consider other options to provide effluent steam sterilization capacity for Building 8100. Over the past four years the government has completed multiple studies to determine the present course of action; to locate the new SSP within Building 8100. Building 8150 decommissioning, repair and operation is not within the scope of this project.

The project includes a dedicated Mechanical, Electrical and Plumbing system to fully support the new EDS system. The SSP MEP system will not

be integrated with the existing whole Building 8100 MEP system. Additional support systems include electrical service, security, lighting, fire protection, building management system communications and supply water for the EDS equipment. Minimum site disturbance shall be needed to provide a construction entrance to the new EDS area, within level 01 of Building 8100. The design build contractor shall provide a design that is in compliance with Department of Defense (DoD) Minimum Antiterrorism for Building standards. Incorporate Cyber Security measures in accordance with UFC 4-010-06. Facilities shall be provided for a minimum life of 50 years in accordance with DoD's Unified Facilities Criteria (UFC 1-200-02) including energy efficiencies and integrated building systems. All structures must comply with the UFCs, Federal, State, installation and local standards. Where conflicts exist between the standards, the most stringent requirements shall govern for the Building 8100 - SSP (Steam Sterilization Plant).

A new continuous flow steam sterilizer plant shall be constructed within the existing Interstitial Pipe Utility space within the non-occupied Room 1SA202. A good portion of the existing utilities within the space shall be removed and/or relocated to provide proper clearance for the new EDS system. Clear maneuvering space shall be provided to initially install the new equipment, allow for future maintenance and replacement of equipment. The specific intent of the project shall be to replace the function of the Building 8150 EDS system and provide a self-sustained EDS system within Building 8100. The new EDS system shall be comprised of Storage Tank Vessels, Solid Removal/Filtration System, Continuous Process Units and additional support equipment. The existing concrete floor at the tank and filtration skid area shall be removed and replaced with a new reinforced concrete slab and footings to support the new equipment. The lowered floor area shall provide a spill containment area in case of an accidental spill. The new reinforced concrete floor and support piles shall be demolished and constructed from within the building. Existing effluent piping from above shall be removed and relocated to discharge directly into the new EDS system. New mechanical, electrical and plumbing systems shall be required to support the new EDS system to be installed within the Room 1SA202.

#### 1.3.1.1 Operation

The new USAMRIID building operates on a 24-hour a Day schedule, with a typical schedule of seven days per-week. Construction of Building 8100 shall be completed and but will not be fully functional at the start of the new EDS SSP project. The Contractor shall be responsible for assuring uninterrupted operational performance of USAMRIID Building 8100 throughout the project duration. Currently, USAMRIID maintains a Temporary EDS (TEDS) system to process effluent from Buildings 1412 and 1425 and current non-contaminated flows from the non-occupied Building 8100. The TEDS system is located at the exterior south side of the building, between USAMRIID and Building 8150. Effluent from Building 8100 to the TEDS system must maintain continuous flow.

The new SSP EDS project shall be designed for operating on a 24-hour a Day schedule, continuously, every day. The base has a 2-day maintenance shut down once a year. The EDS system and EDS MEP systems shall be designed to remain fully functional during this period. The facility may reduce personnel and use during the shutdown period.

#### 1.3.1.2 EDS Overview

The EDS vendor scope starts at the interface between the Biowaste drainage piping and the isolation valves at the Biowaste storage tanks. The Biowaste is processed through multiple EDS vendor-provided skids and the Decontaminated waste is discharged to the building sanitary drainage system. The discharge from the EDS skid is the termination point of the EDS vendors' scope. In addition to the interconnecting piping between the skids and the waste decontamination equipment, the EDS vendor shall also provide support equipment so that the system operates with a single point of responsibility. Support equipment includes but is not limited to a Clean-In-Place and pH neutralization skid which addresses the cleaning requirements of the system and a dedicated heat transfer system which provides the economizers for the EDS system.

All interconnecting piping and wiring between skids, vessels, and other components, shall be part of the EDS manufacturer's scope. All elements of the EDS system, including the Continuous Processing Units shall be developed in a modular approach, meaning that the redundancy, control, and operation shall be segmented to enable:

- a. Future partial replacement by the original manufacturer or an approved equivalent provided.
- b. Future expansion of capacities.
- c. Clarity of on-line vs standby and redundant units.
- d. Segmentation to facilitate maintenance and operational trouble-shooting.

The EDS is comprised of multiple process steps summarized by the listing below (in order of flow path). There are three (3) primary process steps, and several required minor process steps; the primary steps are noted with an '(\*)' in the listing below. Note that the final arrangement may negate select elements, or add components largely as a result of elevation and variability of inflow rates which occur as a result of normal variations throughout the day. The listing below is not intended to address full detailing such as line arrangements, parallel components or redundancies, nor ancillary processes such as control and monitoring, pH correction or thermal or chemical component decontamination.

- a. Storage (Queue) Vessels (\*)
- b. Recirculation / Solids Reduction Pumps.
- c. Solids Removal / Filtration (\*)
- d. Transfer Pumping Skid
- e. EDS Continuous Process Units (\*)
- f. Heat Transfer Loop and Expansion Tank
- g. Clean-In-Place Descaling / pH Neutralization Skids

#### 1.3.1.3 MEP Overview

New MEP system shall be provided as scope for this project to support the

new EDS system. New EDS support MEP equipment shall be separated from the existing USAMRIID Building MEP system. Utilities to support the new MEP system shall be provided from the Fort Detrick CUB facilities.

#### 1.3.1.4 Special Design Requirements

Functionality of Building 8100 must be maintained during construction. Effluent flow to the temporary EDS system must be maintained during construction until the new EDS system is functional and commissioned. Temporary secured access onto the site and to the building shall be provided and maintained 24/7 during the entire construction phase of work.

Access for construction workers and supply vehicles needs must be understood prior to submitting proposals. A Pre-Bid meeting will be held with bidding contractors and the Fort Detrick garrison to provide security logistic information of the Fort Detrick site security requirements. It is the contractor's responsibility to determine the requirements and schedule the necessary time to provide access for personnel and supplies to the project site.

#### 1.3.1.5 Building Commissioning

The Contractor shall provide commissioning to meet requirements identified in Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING, and UFC 1-200-02 High Performance and Sustainable Building Requirements.

#### 1.3.1.6 Access to Service Existing USAMRIID Facilities Equipment/Devices During SSP Construction

The Contractor shall provide RIID access to all serviceable equipment and devices in the Biowaste zone throughout the entire duration of SSP project. Contractor shall coordinate with USACE the access to all existing serviceable equipment/devices to remain in the work area for USAMRIID Facilities and/or others maintaining the equipment and devices. The Contractor shall provide protection to all remaining equipment, devices, piping, conduit, and surfaces, etc., throughout the contract; and shall provide final cleaning of existing surfaces at end of contract as specified in 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.3.2 Location

The work is located at Fort Detrick, Maryland. The site is bounded by Schreider Street, Doughten Drive, and Chandler Street. The project includes a parking area located northwest of Chandler Street. The site is constrained to the east by the Building 810 loading dock access and to the west by a Ft. Detrick water easement.

#### 1.4 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

## Repair Steam Sterilization Plant (SSP)

### 1.5 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

### 1.6 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 1 week prior to excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

#### 1.6.1 Notification Prior to Excavation

Notify the Contracting Officer at least 1 week prior to starting excavation work.

### 1.7 GOVERNMENT-FURNISHED MATERIAL AND EQUIPMENT

#### 1.7.1 Delivery Schedule

Notify the Contracting Officer in writing at least 30 calendar days in advance of the date on which the materials and equipment are required. Pick up materials and equipment no later than 30 calendar days after such date.

### 1.8 SALVAGE MATERIAL AND EQUIPMENT

Items designated by the Contracting Officer to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at the Government designated storage area as directed by the Contracting Officer.

Provide a salvage plan, listing material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Provide a system for property control in the salvage plan. Store and protect salvaged materials and equipment

until disposition by the Contracting Officer.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 Designer of Record (DOR) Performance Requirements

The design-build document general requirements, performance values, statement of work and technical sections include performance and sizing criteria setting requirements for the Designer of Record (DOR). Where equipment selections and capacities are shown for general concept sizing, they set an expected minimum for the design. If the final design requires an increase in a piece of equipment, a utility or any other element of a complete and functional system meeting the stated criteria, the DOR is responsible to meet that criteria as part of the base scoping and statement of work. The DOR shall size and select their equipment to meet the combined required criteria throughout, and as such, if the final arrangement, selection or similar of a given discipline requires modification to another discipline, those design adjustments are part of the base design-build requirements. If the DOR believes a significant savings is available to USACE for individual pieces which the DOR believes still meet all criteria, the DOR may submit for discretionary approval of USACE voluntary deviation proposals.

-- End of Section --



SECTION 01 14 00

WORK RESTRICTIONS  
11/11, CHG 14: 02/22

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

1.2 SPECIAL SCHEDULING REQUIREMENTS

- a. The Ft. Detrick underground waterline will remain in operation during the entire construction period. The Contractor must conduct his operations so as to cause the least possible interference with normal operations of the activity.
- b. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, include delivery vehicles, are clearly identified with their company name.

1.3.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.2 Coordination

In order to ensure the security and orderly running of Fort Detrick, any contractor personnel who wish to gain access to Fort Detrick shall coordinate with the Fort Detrick Technical Point of Contact (TPOC) and follow OPSEC SOPs established by Fort. Detrick. The Contractor should account for potential delays due to DoD security requirements in its bid or offer.

### 1.3.3 Prescreening

The Contractor must prescreen candidates using the E-verify Program (<http://www.dhs.gov/E-Verify>) website to meet the established employment eligibility requirements. The Vendor must ensure that the candidate has two valid forms of Government issued identification prior to ensure the correct information is entered into the E-verify system. An initial list of verified/eligible Candidates must be provided to the COR no later than 3 business days after the initial contract award.

### 1.3.4 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

### 1.3.5 Working Hours

Regular working hours will consist of an 8 1/2 hour period , between 7 a.m. and 3:30 p.m., Monday through Friday , 7 a.m. and 11 p.m. on Saturday, excluding Government holidays.

### 1.3.6 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

### 1.3.7 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and any other utilities serving occupied buildings are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is

required.

#### 1.3.8 Coordination with Utility Providers

Coordinate with the USACE Resident Engineer (RO) and with the Ft. Detrick Directorate of Public Works (DPW) relative to all utility work including but not limited to domestic water, wastewater, natural gas service, electricity, and communications. In some instances, utilities on the site are managed and maintain by joint agreements between Ft. Detrick and their various partners. When public utilities are involved, work shall be performed in accordance with the most restrictive requirements of either entity.

##### 1.3.8.1 Domestic Water Service

Water service is provided through Fort Detrick. Coordinate with USACE RO and Ft. Detrick DPW.

Completion of the Project; including the demolition of several existing structures; will be required in close proximity and in some instances directly above a 40-foot wide Ft. Detrick easement (see Civil drawings) that contains at least three existing distribution lines as follows:

One 18-inch CI W (FC) One 12-inch CI W (FC)

One 8-inch CI W (FC) (ABDN)

Existing records indicate that the water transmission lines date back to circa 1929 and that they have approximately 36-inches of soil cover.

There are no direct utility connections for this Project to any of these existing water lines.

The Contractor shall be responsible for any damage to the existing water line during the course of the Project and as such, extreme caution must be exercised when working above or adjacent the lines to prevent damage or displacement during demolition and construction operations. Such caution includes but is not limited to developing test pits to determine the exact location and depth of the existing lines, restricting mechanized traffic above the existing lines, and limiting the use of heavy wheeled or tracked vehicles to existing pavement crossings. Point of Contact for USACE RO, Ft. Detrick DPW, Phone number for the DPW: 301-619-4357.

##### 1.3.10.2 Natural Gas Service

Gas service is provided by the Frederick Gas Company, a Division of Washington Gas. All service interruptions and connections shall be made in accordance with the utility company. Coordinate with USACE RO, Ft. Detrick DPW and Frederick Gas Company. Phone number for the DPW: 301-619-4357. The Point of Contact for Frederick Gas: <https://www.washingtongas.com/help/contact?&department=builderscontractors>.

#### 1.4 SECURITY REQUIREMENTS

Contract Clause FAR 52.204-2 Security Requirements and Alternate II and the following apply:

Contractor personnel or any representative of the contractor entering Fort

Detrick shall abide by all security rules and regulations. The contractor shall carry passes issued by Fort Detrick for all vehicles entering the base, whether company-owned or employees' private vehicles.

#### 1.4.1 Vehicle Lists

The contractor Project Manager shall maintain a current list of all vehicles and individuals issued such passes. The contractor shall immediately provide a list of these vehicles to include make, model, color, and associated license plate information to the Fort Detrick Security Office or the COR.

#### 1.4.2 Vetting Forms

The contractor shall complete the Fort Detrick Vetting Form for all individuals who will require Fort Detrick access during project execution.

#### 1.4.3 Information Security

IAW AR 380-5, if this is a classified contract, contractor personnel will execute the Non-Disclosure Agreement (NDA) through their company and not through the sponsoring DA command. Non-U.S. Government personnel, who have been hired under Civil Service procedures as consultants to the Department of the Army(DA), and granted a DA security clearance or access authorization, in accordance with AR 380-67, will follow the same procedure, for execution of the SF 312, as civilian personnel. Classified or Unclassified information will be protected at all times, IAW DoD 5200.01, Vol 3, and AR 380-5 either by storage in an approved security container, or having it under the personal observation and physical control of an authorized individual.

#### 1.4.4 Physical Security

The contractor shall be responsible for safeguarding all government equipment, information and property provided for contractor use. At the close of each work period, government facilities, equipment, and materials shall be secured.

#### 1.4.5 Gate Access Requirements

In accordance with Army Directive 2014-05 all personnel desiring unescorted access to Fort Detrick will enter the installation through an authorized Access Control Point (ACP) and be vetted using the National Crime Information Center (NCIC) Interstate Identification Index (III). The Installation Commander will, in the absence of a waiver deny uncleared contractor, subcontractor and visitors unescorted access to the installation based on the results of the NCIC-III check that contains credible derogatory information. Such derogatory information includes, but is not limited to the following:

- a. The NCIC III contains criminal arrest information about the individual that causes the installation Commander to determine that individual present a potential threat to the good order, discipline, or health and safety on the installation.
- b. The Installation is unable to verify the individual's claimed identity in the attempt to gain access.
- c. The individual has a current arrest warrant in NCIC, regardless of the

offense or violation.

- d. The individual is currently barred from entry or access to a federal installation or facility.
- e. The individual has been convicted of crimes encompassing sexual assault, armed robbery, rape, child molestation, production or possession of child pornography, trafficking in humans, drug possession with the intent to sell or distribute.
- f. The individual has a U.S. conviction for espionage, sabotage, treason, terrorism or murder.
- g. The individual is a registered sex offender.
- h. The individual has a felony conviction within the past 10 years, regardless of the offense or violation.
- i. The individual has been convicted of a felony firearms or explosives violation.
- j. The individual has engaged in acts or activities designed to overthrow the U.S. Government by force.
- k. The individual is identified in the Terrorist Screening Database (TSDB) as a known or suspected of being a terrorist, belonging to an organization with known links to terrorism or support of terrorist activity.
- l. Individual is barred from Fort Detrick.

#### 1.4.6 Access Denial Waiver Process

In the event the contractor or subcontractor is denied access based on derogatory information obtained from an NCIC or NCIC III check, the Installation Commander shall offer an Access Denial Waiver Application packet only if the individual request a waiver.

#### 1.4.7 Access to Secure Facilities

Special requirements are required to gain access to a secure facility including but not limited to being a U.S. Citizen or documented legal resident alien. Access to secure facilities on Fort Detrick requires coordination with the Contracting Officer's Representative. Requests for access must be filed 15 days in advance in order to obtain necessary clearances. The contractor shall provide all required personal data on personnel requiring access within the application. Upon completion of work the contractor shall surrender all issued security passes. Final contract payment will be withheld until all passes have been returned. The contractor is required to work with the Contracting Officer's Representative to meet the individual security requirements for that facility in order to gain access. The normal processing time for access is approximately 14 calendar days from the receipt of a complete vetting form (FD 190-13). Vetting forms must be legible. Incomplete or illegible forms will be returned to the contractor for resubmission and will delay access to the installation.

#### 1.4.8 Anti-Terrorism Security Requirements

The contractor and all associated subcontractors' employees shall comply with applicable installation, facility, commander, and local security policies and procedures (provided by the Government COR). The contractor shall also provide all information required for background checks to meet installation access requirements to be accomplished by the installation Provost Marshal Office (PMO), Director of Emergency Services (DES), or Security Office. The contractor workforce must comply with all personal identity verification requirements as directed by DoD, HQDA, and/or local policy. In addition to the changes otherwise authorized by the changes clause of this contract, should the Force Protection Condition (FPCON) at any individual facility or installation change, the Government may require changes in contractor security matters or processes.

#### 1.4.9 Anti-Terrorism Level One (1) Training

All contractor employees, including subcontractor employees, requiring access to Army installations, facilities, or controlled access areas shall complete AT Level I awareness training within 30 calendar days after contract start date or effective date of incorporation of this requirement into the contract, whichever applies. All contractor employees must complete annual AT Level 1 awareness training. Annual training is to be conducted in the anniversary month it was initially completed. The contractor shall submit certificates of completion for each affected contractor employee and subcontractor employee to the COR (or to the contracting officer, if a COR is not assigned) within 15 calendar days after completion of training by all employees and subcontractor personnel. AT Level I training is now conducted on the Joint Knowledge Online (JKO) site. For those that have a CAC, AT Level I can be accessed via <https://jkodirect.jten.mil/Atlas2/faces/page/login/Login.seam>.

- a. For those personnel that do not have a CAC they can utilize the below instructions to complete, i.e. contractors etc.
  - (1) Google JKO and begin the process from there. <http://jko.jten.mil>  
Clicks:
  - (2) No DOD CAC.
  - (3) I am a US mil, government civil servant or contract employee.
  - (4) I've been directed to take required training on JKO.
  - (5) Courses.
  - (6) I do not have a .MIL, .GOV, or .NDU.EDU address or I am a Multi-National Student.
  - (7) Fill out the contact sheet and email to sponsor
  - (8) Sponsor will email to the JKO help desk.

#### Approval

- (1) Help desk sends non-CAC user an email with User ID.
- (2) Help desk will send a separate email with an electronic token to register a new password (token is good for 24 hours).

(3) New User follows the instructions in the email and enters a new password.

(4\_ User will need to enroll in Course # JS-US007-14 (User has up to 1 year to complete the course) (Contractors need to follow the requirements outlined in the AT/OPSEC cover sheet and complete it in 30 days).

c. If training is required in a non-English language, please contact Fort Detrick ATO at [usarmy.detrick.usag.mbx.dptms-antiterrorism@mail.mil](mailto:usarmy.detrick.usag.mbx.dptms-antiterrorism@mail.mil).

#### 1.4.10 iWATCH Awareness Training

The contractor and all associated subcontractors shall brief all employees on the local iWATCH program (training standards provided in this SOW by the Fort Detrick ATO). This locally developed training will be used to inform employees of the types of behavior to watch for and instruct employees to report on suspicious activity to the COR. This training shall be completed within 30 calendar days of contract award and within 30 calendar days of new employees' commencing performance, with the results reported to the COR no later than 5 calendar days after completion. All training materials can be found at:

<http://www.myarmyonesource.com/familyprogramsandservices/iwatchprogram/default.asp>  
or See Something, Say Something:  
<https://www.dhs.gov/see-something-say-something> and iSalute:  
<https://www.inscom.army.mil/isalute/>

#### 1.4.10.1 RAMS and ALERT

AT Level 1 and iWatch Awareness training assist in informing the contractor that at times Random Antiterrorism Measures (RAMS) may be in effect, where their vehicle may be checked, ID cards validated, security checks done by COR and Police. Gate operations could be affected based on the FPCON or RAM. COR is responsible depending on the length of this contract with signing up at least one contractor for ALERT messages for weather or incident alerts, that POC will be responsible for notifying the other contractors by phone tree or other means. The COR is also responsible for ensuring if any blueprints that show information outside of the scope of work that they are either collected back at the end of the job, or destroyed. The maps will not be released outside of anyone not connected with this contract.

#### 1.4.11 Industrial Personnel Security

IAW AR 380-67, AR 380-49 and DOD 5200.2-R, all contracts, classified, sensitive but unclassified and unclassified are required to contain a security clause.: "IAW Army Regulations 380-67, 380-5 and 380-49, the contractor shall ensure all personnel performing under this contract have a completed National Agency Check with Local Checks (NACLC) or Unclassified contracts require a NACI and that it contain no unfavorable information and has been completed by Office of Personnel Management and/or adjudicated by Defense Industrial Security Clearance Office (DISCO) prior to the start of the contract. The security requirements must be maintained for the life of the contract, and citizenship will be verified by presenting an original birth certificate or a valid U.S. Passport or their original Naturalization Certificate to the USAG Security Office at the time of in processing for all contract personnel assigned to the

contract. In order to maintain the security requirements any derogatory information, to include law enforcement issues, mental health issues, or alcohol/drug related issues discovered during the performance of this contract must be reported to the USAG Security Office.

#### 1.4.12 Operational Security (OPSEC) Requirements

It is everyone's responsibility to safeguard personal information and information considered critical to Fort Detrick's operations. All contractor employees shall adhere to USAG Fort Detrick OPSEC policies, regulations, and guidance. Contractor personnel shall not release any personal or operational information to the general public, press, or any other personnel or organizations without prior approval from the USAG Command.

#### 1.4.13 OPSEC Awareness Training

All new employees will complete Level I OPSEC Training within 30 calendar days of their reporting for duty. Additionally, all contractor employees must complete annual OPSEC awareness training. The contractor shall submit certificates of completion for each affected contractor and subcontractor employee, to the COR or to the contracting officer (if COR is not assigned), within 5 calendar days after completion of training. OPSEC awareness training is available at the following websites: <https://www.iad.gov/ioss/> or <https://www.cdse.edu/catalog/operations-security.html>; or it can be provided by the RA OPSEC Officer in presentation form which will be documented via memorandum.

#### 1.4.14 Common Access Card (CAC) Requirements

For contractors requiring Common Access Card (CAC), before CAC issuance, contractor employee requires, at a minimum, a favorably adjudicated National Agency Check with Inquiries (NACI) or an equivalent or higher investigation in accordance with Army Directive 2014-05. The contractor employee will be issued a CAC only if duties involve one of the following: (1) Both physical access to a DoD facility and access, via logon, to DoD networks on-site or remotely; (2) Remote access, via logon, to a DoD network using DoD-approved remote access procedures; or (3) Physical access to multiple DoD facilities or multiple non-DoD federally controlled facilities on behalf of the DoD on a recurring basis for a period of 6 months or more. At the discretion of the sponsoring activity, an initial CAC may be issued based on a favorable review of the FBI fingerprint check and a successfully scheduled NACI at the Office of Personnel Management.

#### 1.4.15 Escorts

All contract employees, including subcontractor employees, who are not in possession of the appropriate security clearance, will be escorted in areas where they may be exposed to classified and/or sensitive materials and/or sensitive or restricted areas.

#### 1.4.16 Cybersecurity

- a. The contractor must comply with UFC 4-010-06 CYBERSECURITY OF FACILITY-RELATED CONTROL SYSTEMS and the Risk Management Framework (RMF).



Repair Steam Sterilization Plant (SSP)

- b. Provide completed documentation, using forms with required information as indicated, for work associated with UFGS Division 23 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC), and Division 28 ELECTRONIC SAFETY AND SECURITY. The specifications will be tailored to state the specific implementation requirements to satisfy UFC 4-010-06.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 20 00.00 10

PRICE AND PAYMENT PROCEDURES

11/20, CHG 2: 08/21

PART 1 GENERAL

1.1 UNIT PRICE PAYMENT ITEMS

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the PRICE SCHEDULE and described below. The unit price and payment made for each item listed constitutes full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

1.1.1 Rock Excavation (Mass Excavation)

1.1.1.1 Payment

Payment will be made for costs associated with rock excavation for the structure, which includes performing required excavation and other operations incidental thereto, and for removal and disposal of excess excavate material.

1.1.1.2 Measurement

The total quantity of excavated rock material for which payment will be made will be the difference between the quantities that can be reasonably determined in Section 31 00 00 EARTHWORK and the ultimate volume of rock removed. Rock is defined as any material which cannot be dislodged by a heavy tracked-type tractor (D-8 or equivalent) with a hydraulically operated, single-tooth power ripper without the use of hoe-ramming. This classification does not include materials that can be removed by means other than hoe-ramming, but which for reasons of economy in excavating, the Contractor chooses to remove by hoe-ramming. Rock does not include boulders less than 1 cubic yard in volume. Boulders larger than 1 cubic yard in volume will be considered rock for payment purposes. No allowance will be made for over depth excavation or for the removal of any material outside the required slope lines unless authorized.

Potential bidders shall include a minimum of 1,000 cubic yards of rock excavation (mass excavation) within their proposals. When supported by verifiable documentation, additional rock excavation (mass excavation) will be compensated on a unit as provided by the Contractor in the proposed Bid Schedule.

1.1.1.3 Unit of Measure

Unit of Measure: Cubic yard.

1.1.2 Rock Excavation (Trench)

1.1.2.1 Payment

Payment will be made for costs associated with rock excavation for utilities, footing, and pits, which includes performing required

excavation and other operations incidental thereto, and for removal and disposal of excess excavate material.

#### 1.1.2.2 Measurement

The total quantity of excavated rock material for which payment will be made will be the difference between the quantities that can be reasonably determined in Section 31 00 00 EARTHWORK and the ultimate volume of rock removed. Rock is defined as any material which cannot be dislodged by a heavy tracked-type excavator (235C or equivalent) with a medium stick and a rock ripping bucket without the use of hoe-ramming. This classification does not include materials that can be removed by means other than hoe-ramming, but which for reasons of economy in excavating, the Contractor chooses to remove by hoe-ramming. Rock does not include boulders less than 1 cubic yard in volume. Boulders larger than 1 cubic yard in volume will be considered rock for payment purposes. No allowance will be made for over depth excavation or for the removal of any material outside the required trench lines unless authorized.

Potential bidders shall include a minimum of 320 cubic yards of rock excavation (trench) within their proposals. When supported by verifiable documentation, additional rock excavation (trench) will be compensated on a unit cost basis as provided by the Contractor in the proposed Bid Schedule.

#### 1.1.2.3 Unit of Measure

Unit of Measure: Cubic yard.

#### 1.1.3 Micropile Drilling

##### 1.1.3.1 Payment

Payment will be made for costs associated with overdrilling of micropiles and other operations incidental thereto, Contractor-furnished disposal area(s) and disposition of excess excavate material and unsuitable and frozen materials.

##### 1.1.3.2 Measurement

The total drilling depth of all micropiles for which payment will be made will be the theoretical quantity greater than 20% of the cumulative length as could be reasonably determined by evaluating the existing geotechnical information provided with the Contract Document and as necessary to achieve the required frictional resistance as prescribed in the drawings and specifications.

Potential bidders shall include a minimum of 3300 linear feet of micropile drilling within their proposals. When supported by verifiable documentation, additional micropile drilling will be compensated on a unit as provided by the Contractor in the proposed Bid Schedule.

##### 1.1.3.3 Unit of Measure

Unit of Measure: Linear foot.

## Repair Steam Sterilization Plant (SSP)

### 1.1.4 Flowable Fill

#### 1.1.4.1 Payment

Cost associated providing low strength self-compacting, cementitious flowable for the express purpose of filling voids due to Karst geology.

#### 1.1.4.2 Measurement

Total cost including furnishing, transporting, and placing of fillable fill as specified in Division 31 of the specifications. Measurement will not include material placed outside of the neat line limits or outside of the adjusted limits, or for unused or wasted material.

Potential bidders shall include a minimum of 60 cubic yards of flowable fill within their proposals. When supported by verifiable documentation, additional flowable fill will be compensated on a unit cost basis as provided by the Contractor in the proposed Bid Schedule.

#### 1.1.4.3 Unit of Measure

Unit of Measure: Cubic yard.

### PART 2 PRODUCTS

Not Used

### PART 3 EXECUTION

Not Used

Attachment: Price Schedule

-- End of Section --

UNIT PRICE SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Price	Amount
0001	All design costs in connection with construction of the REPAIR Steam Sterilization Plant (SSP), complete as shown on drawings and specified.	----	JOB	----	\$ _____
0001E	All design costs necessary for the fabrication/construction of the EDS System for the Steam Sterilization Plant (SSP) including but not limited to connective piping, power, instrumentation, monitoring and control of both the EDS Process Units, and supervisory monitoring and control of all EDS sub-process units, including but not limited to Storage Tanks, Pumping, Filtration, and Clean-In-Place (CIP) as shown on drawings and specified.	----	JOB	----	\$ _____
0002	All costs in connection with the Commissioning planning and specifications during design, complete as shown on drawings and specified.	----	JOB	----	\$ _____

0003 All costs in connection with the ----- JOB ----- \$ \_\_\_\_\_  
construction cost OUTSIDE of 5ft  
line (i.e., site and utility,  
outside the B8100 facility),  
complete as shown on drawings  
and specified.

0004 All costs in connection with ----- JOB ----- \$ \_\_\_\_\_  
construction INSIDE of 5 ft  
line (with the exception of  
work directly associated with  
the EDS), including  
Control/Work Room,  
Change/Shower/Janitor Closet  
architecture, and fit-out;  
revised/new biowaste piping  
and venting outside of the  
EDS system scoping;  
Electrical, Lighting, Fire  
Alarm and Security/Access  
Control; HVAC, Mechanical,  
Plumbing, Fire Protection,  
BMS; infrastructure and non-  
EDS Commissioning; and  
General Conditions, complete  
as shown on the drawings and  
specified.

0005 All costs in connection with the EDS Continuous Process Equipment; EDS Pumping, Clean-In-Place (CIP), and Filtration equipment; and EDS storage tanks and equipment, including connective piping, power, instrumentation; monitoring and control of both the EDS Process Units, and supervisory monitoring and control of all EDS sub-process units, including but not limited to Storage Tanks, Pumping, Filtration, and Clean-In-Place (CIP) local instrumentation & control; EDS installation labor; EDS testing/FAT, on-site tuning, calibration, start-up, Cx, and training, complete as shown on drawings and specified.

----- JOB ----- \$ \_\_\_\_\_

---

TOTAL BASE BID AMOUNT \$ \_\_\_\_\_

---

OPTIONS TO COST ABOVE

0006a	All costs in connection with an extension of the standard warranty for the complete EDS of one additional year (i.e., the standard one year warranty plus one year).	-----	1 <sup>ST</sup> ADD'L YEAR	ADD OPTION	\$ _____
0006b	All costs in connection with an extension of the standard warranty for the complete EDS of one additional year (i.e., one additional year beyond the two years in CLIN 0006a).	-----	2 <sup>ND</sup> ADD'L YEAR	ADD OPTION	\$ _____
0007	All costs in connection with solids filtration system add-on feature for auto-flushing.	-----		ADD OPTION	\$ _____

---

TOTAL OPTIONS AMOUNT \$ \_\_\_\_\_

---

TOTAL BID AMOUNT  
WITH OPTIONS \$ \_\_\_\_\_

---

NOTES TO BIDDERS

Offerors must quote on all items. Failure to quote on all items may be cause for rejection of the proposal.

CLIN 0006a and CLIN 0006b may be exercised at any time within 18 months after the date of receipt of Notice to Proceed. CLIN 0007 may be exercised within 180 days after the date of receipt of Notice to Proceed. The Contracting Officer may exercise the Optional Items by written notice to the Contractor, postmarked within the period specified above. The Government may exercise any, all or none of the listed Optional Items in any order.

Evaluation of Options:

Except when it is determined not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the Option(s).



SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

11/20, CHG 2: 05/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

(2014) Safety -- Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map

Progress and Completion Pictures

1.3 VIEW LOCATION MAP

Submit, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit with the monthly invoice two sets of digital photographs, each set on a separate compact disc (CD) or data versatile disc (DVD), cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch on the CD or DVD as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Government.

## 1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by State law.

## 1.6 SUPERVISION

### 1.6.1 Superintendent Qualifications

Provide project superintendent with a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

For projects where the superintendent is permitted to also serve as the Quality Control (QC) Manager as established in Section 01 45 00.00 10 QUALITY CONTROL, the superintendent must have qualifications in accordance with that section.

### 1.6.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

### 1.6.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

### 1.6.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

## 1.7 PRECONSTRUCTION CONFERENCE

Upon completion of design and design acceptance by the government, prior to commencing any work at the site, coordinate with the Contracting

Officer a time and place to meet for the Preconstruction Conference. The purpose of this conference is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

#### 1.7.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

#### 1.8 PARTNERING

To most effectively accomplish this Contract, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, , Contractor, key subcontractors and the Designer of Record are required to participate in the Partnering process.

##### 1.8.1 Facilitated (Formal) Partnering

- a. Within 35 calendar days after award and prior to the start of work, host a Formal Partnering session with key personnel from the project team including both Contractor and Government personnel. All costs associated with the Partnering session including the third-party independent Facilitator Consultant, meeting room and other incidental items are the responsibility of the Contractor.
- b. Before the Facilitated (Formal) Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note pads, pens/pencils, colored flash cards) and have these items available at the Partnering session. Provide copies of any documents required for distribution to all attendees. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.
- c. The Initial Partnering Session must be a duration of one day and be held at a location off base as agreed to by the Contracting Officer. Partnering session may take place concurrently with the Meeting.
- d. Facilitator must be experienced in conducting corporate Partnering sessions and must be a third-party independent facilitating consultant - not an employee of the Contractor. The Facilitator is responsible for leading all aspects of the Partnering session necessary to achieve the Partnering goal.
- e. An outcome of the Partnering session must be an escalation matrix agreed upon by both the Government and Contractor, which identifies

## Repair Steam Sterilization Plant (SSP)

key Government and Contractor decision makers by name and anticipated decision durations.

- f. Host follow-on Partnering Sessions at three- to six-month intervals or more frequently if needed and lasting generally a half day or less. Attendees need only be those required to resolve current issues. The same Facilitator used in the Initial Partnering session must lead the follow-on sessions unless an alternative is permitted by the Contractor Officer. All costs associated with follow-on Partnering sessions are the responsibility of the Contractor.

### PART 2 PRODUCTS

Not Used

### PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 31 11

SUSPENDED LOADING - COORDINATION AND LIMITATIONS

07/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01

(2018; with Change 1, 2020) DoD Minimum  
Antiterrorism Standards for Buildings

1.2 APPLICATION OF THIS SECTION

1.2.1 Suspended Loads

This Section applies to all Sections of the Project Manual where work involves suspended loads from roof, floor decks and concrete floor slabs.

1.2.2 Exceptions

The following categories of work are excluded from restrictions of this Section, and are subject only to requirements of their respective Sections:

- a. Gypsum Board Ceilings.
- b. Acoustical Ceilings.
- c. Ductwork Systems.
- d. Interior Lighting.

1.3 INTENT

1.3.1 Suspended Loading

Intent of this Section is to establish installation methods and procedures to ensure that suspended loading is uniformly distributed so as not to overstress any portion of the structure.

1.3.2 Hanging Requirements

This Section is not intended to reduce specific hanging requirements specified elsewhere.

1.4 PRE-INSTALLATION MEETINGS

1.4.1 Schedule

Schedule one or more pre-installation meetings to specifically review each provision of this Section.

## Repair Steam Sterilization Plant (SSP)

### 1.4.2 Plan and Ccoordinate Work

Plan and coordinate work, so that collective loads (from one or more trades) superimposed on building floor, roof deck or concrete floor slabs does not exceed maximum concentrated loads specified.

### 1.4.3 Attendance Required

All parties as appropriate to accomplish the work of this Section.

### 1.5 DEFINITIONS

Primary Structural Steel and Concrete Framing: Columns, Girders, Beams, and Concrete Floor Slabs and Shear Walls. All other members are considered secondary.

## PART 2 PRODUCTS

Not Used.

## PART 3 EXECUTION

### 3.1 HANGING FROM DECKS

#### 3.1.1 Steel Roof Or Floor Decks

Do not hang directly from steel roof or floor decks. Where suspensions are required, hang directly from primary structural steel framing, and provide supplemental framing attached to the primary structural framing, as required. Do not suspend from secondary members.

#### 3.1.2 Roof Decks With Structural Concrete

Hang from steel roof decks with structural concrete fill as specified for floor decks.

### 3.2 HANGING FROM FLOOR DECKS OR CONCRETE FLOOR SLABS

The following spacing and load limitations are collective and apply to ALL specifications Sections (except those listed above as being excluded), regardless of size or use, or whether the load is hung singularly or collectively in a trapeze. When calculating piping or conduit loads, include contents of pipe or conduit. When calculating dry pipe systems, assume pipe is filled with water.

Spacing of Insert or Deck Attachment	Maximum Concentrated Collective Load from One or More Trades
24 Inches	150 pounds
36 Inches	280 pounds
48 Inches	500 pounds

### 3.3 RESTRICTIONS

#### 3.3.1 Concentrated Loads Over 500 Pounds

Inserts or deck attachments are not permitted. Suspend these loads directly from primary structural steel and concrete framing, and provide supplemental framing attached to primary framing, as required. Do not suspend from secondary members.

#### 3.3.2 Rotating and Reciprocating Equipment

Same as concentrated loads over 500 pounds.

#### 3.3.3 Inserts Oor Deck Attachments

Locate inserts or attachments at bottom flutes of deck only.

### 3.4 CRITERIA FOR SUPPORTING EQUIPMENT IN NORMALLY OCCUPIED SPACES

Standards referenced below do not preclude the need to design equipment mountings for forces required by other criteria specified such as seismic standards.

#### 3.4.1 Overhead Mounted Architectural Features

Follow UFC 4-010-01; B-3.6 Standard 15. Overhead Mounted Architectural Features: Overhead mounting features/systems weighing 31 pounds or greater shall be mounted to resist forces of 0.5 times the component weight in any direction and 1.5 times the component weight in the downward direction.

#### 3.4.2 Equipment Bracing

Follow UFC 4-010-01; B-4 ELECTRICAL AND MECHANICAL DESIGN, B-4.5 Standard 20 Equipment Bracing: mount overhead utilities and other fixtures weighing 31 pounds or greater to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

-- End of Section --

SECTION 01 32 01.00 10

PROJECT SCHEDULE

02/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AACE INTERNATIONAL (AACE)

AACE 29R-03 (2011) Forensic Schedule Analysis

AACE 52R-06 (2006) Time Impact Analysis - As Applied in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (2017) Administration -- Project Schedules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G

Preliminary Project Schedule; G

Initial Project Schedule; G

Periodic Schedule Update; G

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 2-years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules



## Repair Steam Sterilization Plant (SSP)

required herein must be capable of meeting all requirements of this specification.

### 2.1.1 Government Default Software

The Government intends to use Primavera P6.

### 2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

#### 2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system.

#### 2.1.2.2 Other Than Primavera

If the contractor chooses software other than Primavera P6, that is compliant with this specification, provide for the Government's use two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of design and construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Designers, Subcontractors and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

### 3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN.

#### 3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

### 3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

## 3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

### 3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

### 3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 20 work days or 30 calendar days.

### 3.3.3 Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. Provide at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Also include review and correction periods associated with each item.

### 3.3.4 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

### 3.3.5 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of design packages.
- c. Submission of mechanical/electrical/information systems layout

drawings.

- d. Long procurement activities
- e. Submission and approval of O & M manuals.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.
- h. Submission and approval of testing and air balance (TAB).
- i. Submission of TAB specialist design review report.
- j. Submission and approval of fire protection specialist.
- k. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.
- l. Air and water balancing.
- m. Building commissioning - Functional Performance Testing.
- n. Controls testing plan submission.
- o. Controls testing.
- p. Performance Verification testing.
- q. Other systems testing, if required.
- r. Contractor's pre-final inspection.
- s. Correction of punch list from Contractor's pre-final inspection.
- t. Government's pre-final inspection.
- u. Correction of punch list from Government's pre-final inspection.
- v. Final inspection.

#### 3.3.6 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: acceptance, design reviews, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

#### 3.3.7 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign all Activity Codes to activities as detailed herein. A

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template SDEF compatible schedule backup file is available on the QCS web site: <http://rms.usace.army.mil>.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*
*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.			

### 3.3.7.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, if directed by the Contracting Officer. Workers per day is based on the average number of workers expected each day to perform a task for the duration of that activity.

### 3.3.7.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

- a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.
- b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

#### 3.3.7.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Not all activities are required to be Work Area coded. A lack of Work Area coding indicates the activity is not resource or space constrained.

#### 3.3.7.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

#### 3.3.7.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Schedule (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

#### 3.3.7.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are design phase, procurement phase and construction phase. Each activity can have only one Phase of Work code.

- a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.
- b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

#### 3.3.7.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to design, design submittal, design reviews, review conferences, permits, construction submittal, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no more than one Category of Work Code.

#### 3.3.7.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section 01 45 00.00 10 QUALITY CONTROL. An activity can have only one Feature of Work Code.

### 3.3.8 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

#### 3.3.8.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

#### 3.3.8.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

#### 3.3.8.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

##### 3.3.8.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

##### 3.3.8.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

### 3.3.9 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop sSeasonal Calendar(s) and assign to seasonally affected activities as applicable.

If an activity is weather sensitive it should be assigned to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated adverse weather delay work days provided in the Special Contract Requirements. Assign non-work days over a seven-day week as weather records are compiled on seven-day weeks, which may cause some of the weather related non-work days to fall on weekends.

### 3.3.9.1 Anticipated Adverse Weather Delays

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all-weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON (5) DAY WORK WEEK											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12	7	7	9	7	7	6	6	4	5	5	7

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time only extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities are on the longest path to contract completion in the period when delay occurred. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity. Impacts resulting from adverse weather must be documented in Narrative Report for the month that it occurred.

### 3.3.10 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" may have no predecessor logic, and the last activity -"End Project" may have no successor logic.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

### 3.3.11 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in

disapproval of the Contractor's schedule.

#### 3.3.12 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

#### 3.3.13 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

#### 3.3.14 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

#### 3.3.15 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

- a. Leads (negative lags) are prohibited.
- b. Start to Finish (SF) relationships are prohibited.

#### 3.3.16 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

#### 3.3.17 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

#### 3.3.18 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.



### 3.3.19 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

#### 3.3.19.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than \$35,000 or 1 percent of the present contract value, which ever is greater, up to \$200,000. Activity will be declared 100 percent complete upon the Government's approval.

#### 3.3.19.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than \$20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

### 3.3.20 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

- a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.
- b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

### 3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD/DVD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

#### 3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining

performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Activity code any activities that are summary in nature after the first 90 calendar days with Bid Item (CLIN) code (BIDI), Responsibility Code (RESP) and Feature of Work code (FOW).

#### 3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. Include in the design-build schedule detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead item acquisition prior to design completion. Also cover in the initial design-build schedule the entire construction effort with as much detail as is known at the time but, as a minimum, include all construction start and completion milestones, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the then approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone. No payment will be made for work items not fully detailed in the Project Schedule.

##### 3.4.2.1 Design Package Schedule Submission

With each design package submitted to the Government, submit a fragment schedule extracted from the then current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

#### 3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress. Update the schedule to include detailed construction activities as the design progresses, but not later than the submission of the final un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission if such activity is authorized.

- a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete is subject to the approval of the Government at the meeting.
- b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

### 3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

#### 3.5.1 Data CD/DVDs

Provide two sets of data CD/DVDs containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include on the data CD/DVDs the Narrative Report and all required Schedule Reports. Label each CD/DVD indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

#### 3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for any problems, either current or potential, which are revealed through that analysis. Include the following information as minimum in the Narrative Report:

- a. Identify and discuss the work scheduled to start in the next update period.
- b. A description of activities along the two most critical paths where the total float is less than or equal to 20 work days.
- c. A description of current and anticipated problem areas or delaying factors and their impact and an explanation of corrective actions taken or required to be taken.
- d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.
- e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.
- f. Identify and discuss out-of-sequence work.

#### 3.5.3 Schedule Reports

The format, filtering, organizing and sorting for each schedule report will be as directed by the Contracting Officer. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date,

## Repair Steam Sterilization Plant (SSP)

Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. Provide two set(s) of hardcopy reports. The following lists typical reports that will be requested:

### 3.5.3.1 Activity Report

List of all activities sorted according to activity number.

### 3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

### 3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

### 3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

### 3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

## 3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

### 3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

### 3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

#### 3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

#### 3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

#### 3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

### 3.6 PERIODIC SCHEDULE UPDATE

#### 3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Provide a draft of the proposed narrative report and schedule data file to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager and scheduler must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make corrections to the draft submission. Include only those changes approved by the Government in the submission and invoice for payment.

#### 3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

### 3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address

the status of RFIs, RFPs and Submittals.

### 3.8 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP) to justify time extensions.

#### 3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

#### 3.8.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on industry standard AACE 52R-06. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

#### 3.8.3 Forensic Schedule Analysis (Retrospective Analysis)

Prepare an analysis for approval by the Contracting Officer based on industry standard AACE 29R-03.

#### 3.8.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

#### 3.8.5 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

### 3.8.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact.

### 3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

#### 3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

#### 3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

#### 3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

### 3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, may not be considered for the exclusive use of either the Government or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

### 3.11 TRANSFER OF SCHEDULE DATA INTO RMS/QCS

Import the schedule data into the Quality Control System (QCS) and export the QCS data to the Government. This data is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and matching electronic export from QCS of the application for progress payment.

### 3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

If Primavera P6 is being used, request a backup file template (.xer) from the Government, if one is available, prior to building the schedule. The following settings are mandatory and required in all schedule submissions to the Government:

- a. Activity Codes must be Project Level, not Global or EPS level.
- b. Calendars must be Project Level, not Global or Resource level.
- c. Activity Duration Types must be set to "Fixed Duration & Units".
- d. Percent Complete Types must be set to "Physical".
- e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.
- f. Set Schedule Option for defining Critical Activities to "Longest Path".
- g. Set Schedule Option for defining progressed activities to "Retained Logic".
- h. Set up cost loading using a single lump sum labor resource. The Price/Unit must be \$1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.
- i. Activity ID's must not exceed 10 characters.
- j. Activity Names must have the most defining and detailed description within the first 30 characters.

-- End of Section --



SECTION 01 33 00

SUBMITTAL PROCEDURES

08/18, CHG 4: 02/21

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

1.1.2 Project Type

The Contractor and the Designer of Record (DOR), if applicable, are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Submittal Register

Accident Prevention Plan

Quality Control (QC) plan

Environmental Protection Plan

#### SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

#### SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

#### SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

#### SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

#### SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified

requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

#### SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS) concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by

facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

#### SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

#### 1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

#### 1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register; G

#### 1.4 SUBMITTAL CLASSIFICATION

##### 1.4.1 Government Approved (G)

Government approval is required for any variations from the Solicitation or the Accepted Proposal and for other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

#### 1.4.2 Design-Build Submittal Classifications

##### 1.4.2.1 Designer of Record Approved (DA)

Designer of Record (DOR) approval is required for extensions of design; critical materials; any variations from the Solicitation, the Accepted Proposal, or the completed design; equipment whose compatibility with the entire system must be checked; and other items as designated by the Contracting Officer. Provide the Government with the number of copies designated hereinafter of all DOR approved submittals. The Government may review any or all Designer of Record approved submittals for conformance with the Solicitation, the Accepted Proposal, and the completed design. The Government will review all submittals designated as varying from the Solicitation or Accepted Proposal, as described below. Provide design submittals in accordance with Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD). Generally, list design submittals under SD-05 Design Data.

##### 1.4.2.2 Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the Solicitation. Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards, and contract requirements. Design data includes the design documents described in Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD).

##### 1.4.2.3 Designer of Record Approved/Government Conformance Review (DA/CR)

###### 1.4.2.3.1 Variations from the Accepted Design

DOR approval and the Government's concurrence are required for any proposed variation from the accepted design that still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. If necessary to facilitate the project schedule, before official submission to the Government, the Contractor and the DOR may discuss with the Contracting Officer's Representative a submittal proposing a variation. However, the Government reserves the right to review the submittal before providing an opinion. In any case, the Government will not formally agree to or provide a preliminary opinion on any variation without the DOR's approval or recommended approval. The Government reserves the right to reject any design, variation that may affect furniture, furnishings, equipment selections, or operational decisions that were made, based on the reviewed and concurred design.

###### 1.4.2.3.2 Substitutions

Unless prohibited or otherwise provided for elsewhere in the contract, where the Accepted Proposal named products, systems, materials or equipment by manufacturer, brand name, model number, or other specific identification, and the Contractor desires to substitute a manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, through identifying information and the DOR's approval, that the substitute meets the contract requirements and that it is equal in function, performance, quality, and salient features to that in the accepted contract proposal. If the contract otherwise prohibits substitutions of equal named products, systems, materials or equipment by manufacturer, brand name, model number or other specific identification, the request is considered a "variation" to the

contract. Variations are discussed below in paragraphs: "DESIGNER OF RECORD APPROVED/GOVERNMENT APPROVED" and VARIATIONS.

#### 1.4.2.4 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above-stated requirements for proposed variations to the accepted design, both DOR and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed variation to the contract (the Solicitation or the Accepted Proposal), that constitutes a change to the contract terms. The Government reserves the right to accept or reject any such proposed variation.

#### 1.4.3 For Information Only

Submittals not requiring Government approval will be for information only. For Design-build construction all submittals not requiring DOR or Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

#### 1.4.4 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. These submittals are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REPORTING.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

### 1.5 PREPARATION

#### 1.5.1 Transmittal Form

Use the ENG Form 4025-R transmittal form for submitting both Government-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms or similar forms are included in the RMS CM software that the Contractor is required to use for this contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

#### 1.5.2 Submittal Format

##### 1.5.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

#### 1.5.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

- a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.
- b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format.

##### 1.5.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space on the right-hand side of each sheet for the Government disposition stamp.

#### 1.5.2.3 Format of SD-03 Product Data

Present product data submittals for each section as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

##### 1.5.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

##### 1.5.2.3.2 Standards

Where equipment or materials are specified to conform to industry or

technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.5.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

#### 1.5.2.4 Format of SD-04 Samples

##### 1.5.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
- d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet.
- h. Sample Installation: 100 square feet.



#### 1.5.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

#### 1.5.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.5.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

#### 1.5.2.6 Format of SD-06 Test Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.5.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

#### 1.5.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

#### 1.5.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified

organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.5.2.9 Format of SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

#### 1.5.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

#### 1.5.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

### 1.5.3 Source Drawings for Shop Drawings

#### 1.5.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

#### 1.5.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility

of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

#### 1.5.4 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DoD SAFE Web Application located at the following website: <https://safe.apps.mil>.

#### 1.6 QUANTITY OF SUBMITTALS

##### 1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals.

##### 1.6.2 Number of SD-02 Shop Drawing Copies

Submit six copies of submittals of shop drawings requiring review and approval by a QC organization. Submit seven copies of shop drawings requiring review and approval by the Contracting Officer.

##### 1.6.3 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

##### 1.6.4 Number of SD-04 Samples

- a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

## Repair Steam Sterilization Plant (SSP)

- b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of nonsolid materials.

### 1.6.5 Number of SD-05 Design Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

### 1.6.6 Number of SD-06 Test Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

### 1.6.7 Number of SD-07 Certificate Copies

Submit in compliance with quantity requirements specified for shop drawings.

### 1.6.8 Number of SD-08 Manufacturer's Instructions Copies

Submit in compliance with quantity requirements specified for shop drawings.

### 1.6.9 Number of SD-09 Manufacturer's Field Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

### 1.6.10 Number of SD-10 Operation and Maintenance Data Copies

Submit three copies of O&M data to the Contracting Officer for review and approval.

### 1.6.11 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit two sets of administrative submittals.

## 1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Provide information-only submittals to the Contracting Officer a minimum of 14 calendar days prior to the Preparatory Meeting for the associated Definable Feature of Work (DFOW). Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish

material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. For Design-Build construction, the Government will retain copies of information-only submittals.

#### 1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

##### 1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

##### 1.8.2 Design-Build Submittal Register

The Designer of Record develops a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. Complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in

the Contractor prepared progress schedule. Submit monthly or until all submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

#### 1.8.3 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

#### 1.8.4 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

#### 1.8.5 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

## Repair Steam Sterilization Plant (SSP)

### 1.8.6 Action Codes

#### 1.8.6.1 Contractor Action Codes

DESIGN BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS - The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only(FIO)	BLANK	FIO
DA	Submittal requires Designer of Record Approval	D	DA
CR	Submittal requires Government Conformance Review	C	CR
DA/CR	Submittal requires Designer of Record Approval and Government Conformance Review	R	DA/CR
DA/GA	Submittal requires Designer of Record Approval and Government Approval	A	DA/GA

#### 1.8.7 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

## 1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

### 1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

### 1.9.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Contracting Officer, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

The Contracting Officer will indicate an approval or disapproval of the variation request; and if not approved as submitted, will indicate the Government's reasons therefore. Any work done before such approval is received is performed at the Contractor's risk."

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

### 1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

### 1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 10 calendar days will be allowed for the Government to consider submittals with variations.



#### 1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. Allow an additional 14 calendar days for review and approval of submittals for effluent decontamination equipment and refrigeration and HVAC control systems.

- a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.
- b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
- c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 7 calendar days after the date of submission.

##### 1.10.1 Government Reviewed Design

The Government will review design submittals for conformance with the technical requirements of the Solicitation. Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) covers the design submittal and review process in detail. Government review is required for variations from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the DOR's design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required to, review extensions of design such as structural steel or reinforcement shop drawings.

#### 1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

- a. Note the date on which the submittal was received.
- b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate

for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. One copy of the submittal will be retained by the Contracting Officer and remaining copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be identified and returned, as described above.

#### 1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.
- b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.
- c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.
- d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.
- e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

#### 1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

#### 1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

the design, general method of construction, materials, detailing, and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

#### 1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

#### 1.15 WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made unless all required DOR approvals or required Government approvals have been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information-only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

#### 1.16 CERTIFICATION OF SUBMITTAL DATA

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

\_\_\_\_NAME OF CONTRACTOR \_\_\_\_\_ SIGNATURE OF CONTRACTOR

Repair Steam Sterilization Plant (SSP)

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

DRAFT

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Repair Steam Sterilization Plant (SSP)

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 11 00	SD-01 Preconstruction Submittals														
			Salvage Plan	1.8	G												
		01 14 00	SD-01 Preconstruction Submittals														
			List of Contact Personnel	1.3.1.1													
		01 30 00	SD-01 Preconstruction Submittals														
			View Location Map	1.3													
			Progress and Completion	1.4													
			Pictures														
		01 32 01.00 10	SD-01 Preconstruction Submittals														
			Project Scheduler Qualifications	1.3	G												
			Preliminary Project Schedule	3.4.1	G												
			Initial Project Schedule	3.4.2	G												
			Periodic Schedule Update	3.6.2	G												
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal Register	1.8	G												
		01 33 16.00 10	SD-01 Preconstruction Submittals														
			Advanced Modeling Project	1.8.2	C												
			Execution Plan (PxP)														
			Design Quality Control Plan	1.5.1	G												
			Initial Design Conference	1.5.2.2													
			Preconstruction Conference	1.5.2.5													
			DCM Procedures	3.5.1	G												
			Submittal Register	3.7.4	G												
			Risk Assessment	1.7	G												
			SD-05 Design Data														
			Design and Code Checklists	1.8.1	C												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Repair Steam Sterilization Plant (SSP)																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 33 16.00 10	Sustainable Design	2.5	C												
			Equipment Mock Up Definition and Review Procedures														
			Interim Design Submittals	3.2.1	R												
			Interior And Exterior Building Finishes Scheme		G												
			Furniture, Fixtures & Equipment		G												
			Conference Documentation	3.6.3													
			Final Design Submittals	3.7	R												
			Design Complete Documents	3.8	C												
			SD-11 Closeout Submittals														
			DD Form 1354	3.7.5	A												
		01 33 29	SD-01 Preconstruction Submittals														
			Preliminary High Performance and Sustainable Building Checklist	1.5.3.2	G AE/G												
			Sustainability Action Plan	1.4.1	G AE/G												
			Preliminary Sustainability eNotebook	1.5.3.2	G AE/G												
			SD-05 Design Data														
			Interim Design High Performance and Sustainable Building Checklist	1.5.3.2	G AE/G												
			Interim Design Sustainability eNotebook	1.5.3.2	G AE/G												
			Final Design High Performance and Sustainable Building Checklist	1.5.3.2	G AE/G												

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		01 33 29	Final Design Sustainability eNotebook	1.5.3.2	G AE/G												
			SD-11 Closeout Submittals														
			Final High Performance and Sustainable Building Checklist	1.5.3.2	G GA												
			Final Sustainability eNotebook	1.5.3.2	G GA												
			Amended Final Sustainability eNotebook	1.5.3.2	G GA												
			Amended Final High Performance and Sustainable Building Checklist	1.5.3.2	G GA												
		01 35 26	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.7	G												
			Accident Prevention Plan (APP)	1.7	G												
			SD-06 Test Reports														
			Monthly Exposure Reports	1.4													
			Notifications and Reports	1.12													
			Accident Reports	1.12.2	G												
			LHE Inspection Reports	1.12.3													
			SD-07 Certificates														
			Crane Operators/Riggers	1.6.1.4													
			Critical Lift Plan	1.7.3.3	G												
			Activity Hazard Analysis (AHA)	1.8													
			Confined Space Entry Permit	1.9.1													
			Hot Work Permit	1.9.1													
			Certificate of Compliance	1.12.4													

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		01 45 00.00 10	SD-01 Preconstruction Submittals														
			Contractor Quality Control (CQC) Plan	3.2	G												
			Additional Requirements for Design Quality Control (DQC) Plan	3.2.2	G DO												
			SD-05 Design Data														
			Discipline-Specific Checklists	3.2.2													
			Design Quality Control	3.10.1													
			SD-06 Test Reports														
			Verification Statement	3.10.2													
		01 45 35	SD-01 Preconstruction Submittals														
			Project Manual		G												
			Written NDT Practices	3.1.2													
			SD-06 Test Reports														
			Daily Reports	3.1.2													
			Biweekly Reports	3.1.1													
			SD-07 Certificates														
			Piping/Component System Weld Inspection/Criteria Requirements	2.1.1	G												
			Certificate of Compliance	2.1.2													
			Special Inspector	1.5	G												
			Qualification Records	3.1.2													
			SD-11 Closeout Submittals														
			Comprehensive Final Report	3.1.2	G												
		01 50 00	SD-01 Preconstruction Submittals														
			Construction Site Plan	1.3	G												



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		01 50 00	Traffic Control Plan	3.3.1	G												
			Contractor Computer	1.6.1.4	G												
			Cybersecurity Compliance														
			Statements														
			Contractor Temporary Network	1.6.6	G												
			Cybersecurity Compliance														
			Statements														
			SD-06 Test Reports														
			Backflow Preventer Tests	3.4													
			SD-07 Certificates														
			Backflow Tester	1.4.1													
			Backflow Preventers	1.4													
		01 57 19	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.6.1													
			Solid Waste Management Permit	1.11	G												
			Regulatory Notifications	1.6.2	G												
			Environmental Protection Plan	1.7	G												
			Stormwater Notice of Intent	3.2.1.2	G												
			Dirt and Dust Control Plan	1.7.9.1	G												
			Employee Training Records	1.6.5	G												
			Environmental Manager	1.6.4	G												
			Qualifications														
			SD-06 Test Reports														
			Laboratory Analysis	3.6.1.1.2													
			Monthly Solid Waste Disposal	1.11.1	G												
			Report														

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		01 57 19	SD-07 Certificates														
			Employee Training Records	1.6.5	G												
			Certificate of Competency	1.6.5.1													
			Erosion and Sediment Control	1.6.5													
			Inspector														
			SD-11 Closeout Submittals														
			Stormwater Pollution Prevention	3.2.1.4	G												
			Plan Compliance Notebook														
			Stormwater Notice of Termination	3.2.1.5	G												
			Waste Determination	3.6.1	G												
			Documentation														
			Disposal Documentation for	3.6.3.6	G												
			Hazardous and Regulated Waste														
			Assembled Employee Training	1.6.5	G												
			Records														
			Solid Waste Management Permit	1.11	G												
			Project Solid Waste Disposal	3.6.2.1	G												
			Documentation Report														
			Hazardous Waste/Debris	3.6.3.1	G												
			Management														
			Regulatory Notifications	1.6.2	G												
			Sales Documentation	3.6.2.1	G												
			Contractor Certification	3.6.2.1													
			As-Built Topographic Survey	3.2.1.5													
		01 58 00	SD-02 Shop Drawings														
			Sign Legend Orders	1.4.1	G												

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		01 74 19	SD-01 Preconstruction Submittals														
			Construction Waste Management Plan	1.6	G												
			SD-06 Test Reports														
			Quarterly Reports	1.8.2													
			Annual Report	1.8.3													
			SD-11 Closeout Submittals														
			Final Construction Waste Diversion Report	1.9	S												
		01 78 00	SD-03 Product Data														
			Warranty Management Plan	1.8.1													
			Warranty Tags	1.8.5													
			Spare Parts Data	1.6													
			SD-08 Manufacturer's Instructions														
			Instructions	1.8.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.7	G												
			SD-11 Closeout Submittals														
			As-Built Drawings	3.1	G												
			Record Drawings	3.3	G												
			Record Model	2.2	G												
			As-Built Record of Equipment and Materials	1.8.1													

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		01 78 00	As-Built Record of Equipment and Materials	3.6													
			Final Approved Shop Drawings	3.4	G												
			Construction Contract Specifications	3.5	G												
			Certification of EPA Designated Items	2.3	G												
			Interim DD FORM 1354	3.9.1	G												
			Checklist for DD FORM 1354	3.9.2	G												
			High Performance and Sustainable Building (HPSB) Checklist		G												
		01 78 23	SD-10 Operation and Maintenance Data														
			O&M Database	1.3	G												
			Training Plan	3.1.1	G												
			Training Outline	3.1.3	G												
			Training Content	3.1.2	G												
			SD-11 Closeout Submittals														
			Training Video Recording	3.1.4	G												
			Validation of Training Completion	3.1.6	G												
		01 78 24.00 10	SD-01 Preconstruction Submittals														
			Facility Data Project Execution Plan	1.5.1													
			SD-05 Design Data														
			Facility Data Workbook, Design	3.1	G												

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		01 78 24.00 10	Facility Document Set, Design SD-10 Operation and Maintenance Data	3.1	G												
			Facility Data Workbook, Construction Progress	3.2	G												
			Facility Document Set, Construction Progress	3.2	G												
			SD-11 Closeout Submittals														
			Facility Data Workbook, Construction Final	3.3	G												
			Facility Document Set, Construction Final	1.5.3	G												
			Facility Document Set, Construction Final	3.3	G												
		01 91 00.15 10	SD-01 Preconstruction Submittals														
			Commissioning Firm	1.8	G DO												
			Lead Commissioning Specialist	1.8.1	G DO												
			Technical Commissioning Specialists	1.8.2	G DO												
			Commissioning Firm's Contract	1.8	G DO												
			SD-05 Design Data														
			Design Phase Commissioning Plan	3.1.2	G DO												
			SD-06 Test Reports														
			Design Review Report	3.1.3	G DO												

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		01 91 00.15 10	Interim Construction Phase Commissioning Plan	3.2.2.1	G DO												
			Final Construction Phase Commissioning Plan	3.2.2.2	G DO												
			Factory Acceptance Test Scripts		G DO												
			Factory Acceptance Test Reports		G DO												
			Pre-Functional Checklists	3.2.5.2	G DO												
			Issues Log	1.9													
			Commissioning Report	3.3	G DO												
			Post-Construction Trend Log Report	3.4.1	G DO												
			SD-07 Certificates														
			Certificate of Readiness	1.10	G DO												
			SD-10 Operation and Maintenance Data														
			Training Plan	3.2.6	G RO												
			Training Attendance Rosters	3.2.6	G RO												
			Systems Manual	3.2.7	G DO												
			Maintenance and Service Life Plans	3.2.8	G DO												
			SD-11 Closeout Submittals														
			Final Commissioning Report	3.3	S DO												
			Final Construction Phase Commissioning Plan	3.2.2.2	S												
		02 41 00	SD-01 Preconstruction Submittals														
			Existing Conditions	1.6.2	G AR												

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		02 41 00	SD-07 Certificates														
			Demolition and Deconstruction Plan	1.9	G												
			Notifications	1.4.1	G												
			SD-11 Closeout Submittals														
			Receipts	1.4.2													
		03 45 01.00 10	SD-02 Shop Drawings														
			Erection	3.1	G AE												
			SD-04 Samples														
			Precast Concrete Units	2.2	G AE												
			Mock-up	1.4.7	G AE												
			SD-05 Design Data														
			Calculations	1.4.5	G AE												
			Mix Design	1.4.6	G AE												
			Manufacturer's Qualifications	1.3													
			SD-06 Test Reports														
			Materials	2.1													
			SD-07 Certificates														
			Installer Qualifications	1.3.1	G AR												
			Field Auditor Qualifications	1.3.2	G AR												
			Fabricator Qualifications	1.3.3	G AR												
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1	G AR/A												
			Frames	2.4	G AR/A												
			Accessories	2.3	G AR/A												
			SD-03 Product Data														

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		08 11 13	Doors	2.1	G AR/A												
			Frames	2.4	G AR/A												
			Accessories	2.3													
			Fire Rating	2.5.1	G AR/A												
		09 67 00	SD-01 Preconstruction Submittals														
			Early Submittal Package	1.5	G AE												
			Schedule	2.3	G AE												
			SD-02 Shop Drawings														
			Flooring	2.1.3	G AE												
			SD-03 Product Data														
			Flooring	2.1.3	G AE												
			SD-04 Samples														
			Flooring	2.1.3	G AE												
			Mock-Up	1.7.6	G AE												
			SD-07 Certificates														
			Installer	1.7.2													
			Report	3.2.5													
			Report	3.2.5													
			Report	3.5.1													
			Report	3.5.1													
			SD-08 Manufacturer's Instructions														
			Application	3.6													
			SD-10 Operation and Maintenance														
			Data														
			Flooring System	2.1.2	G AR												
			SD-11 Closeout Submittals														



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		09 67 00	Warranty	1.11													
		21 13 13	SD-01 Preconstruction Submittals														
			Qualified Fire Protection Engineer (QFPE)	1.2.3	G												
			Sprinkler System Designer	1.4.2.1	G												
			Sprinkler System Installer	1.4.2.2	G												
			SD-02 Shop Drawings														
			Shop Drawing	1.2.1.1	G												
			SD-03 Product Data														
			Pipe	2.2.1.1	G												
			Fittings	2.2.1.2	G												
			Valves	2.2.4	G												
			Sprinklers	2.4	G												
			Pipe Hangers and Supports	2.2.3	G												
			Sprinkler Alarm Switch	2.3.1	G												
			Valve Supervisory (Tamper) Switch	2.3.2	G												
			Hose Valve	2.2.4.3	G												
			Seismic Bracing	2.2.3	G												
			Nameplates	2.1.2	G												
			SD-05 Design Data														
			Seismic Bracing	2.2.3	G												
			Hydraulic Calculations	1.2.1.2	G												
			SD-06 Test Reports														
			Test Procedures	3.6.1	G												
			SD-07 Certificates														

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		21 13 13	Verification of Compliant Installation	3.6.2.1	G												
			Request for Government Final Test	3.6.2.2	G												
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance (O&M) Instructions	3.8	G												
			Spare Parts	1.6	G												
			SD-11 Closeout Submittals														
			As-built drawings	3.8													
		22 00 00	SD-02 Shop Drawings														
			Plumbing System	3.14.1	G AE												
			SD-03 Product Data														
			Plumbing System	3.14.1	G AE												
			Local/Regional Materials	1.18.1													
			Environmental Data														
			Materials	2.1													
			Backflow prevention	3.6	G AE												
			Welding	1.9.1													
			Vibration-Absorbing Features	3.9	G AE												
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.14													
			Backflow Prevention	3.6													
			SD-07 Certificates														
			Materials and Equipment	1.7													

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		22 00 00	Bolts	2.5.3.1													
			SD-10 Operation and Maintenance Data														
			Plumbing System	3.14.1	G AR												
		22 10 06	SD-03 Product Data														
			Piping system components	1.2	G AE												
			SD-06 Test Reports														
			Field test	3.2													
			SD-07 Certificates														
			Field test	3.2													
			Disinfecting	3.3													
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance Data														
			Piping system components	1.2	G AR												
		22 72 00.01	SD-01 Preconstruction Submittals														
			Vendor Experience	2.1	G												
			quality assurance		G												
			biological efficacy testing data		G												
			Utility Coordination		G												
			Risk Analysis		G												
			design		G												
			SD-02 Shop Drawings														
			P&ID		G												
			Mechanical Fabrication Drawings		G												

# SUBMITTAL REGISTER

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TITLE AND LOCATION

Repair Steam Sterilization Plant (SSP)

CONTRACTOR

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		22 72 00.01	Electrical Fabrication Drawings		G												
			Sequence of Operations	2.3.1	G												
			SD-03 Product Data														
			Actuators Control Valves		G												
			Desktop Computers Electrical Panels		G												
			Flow transmitters	2.12.9	G												
			Heat Transfer System	2.8	G												
			HEPA Vent Filters	2.9	G												
			Insulation	2.10.8	G												
			Isolation Valves	2.10.2	G												
			Leak Detection	2.14	G												
			Level Transmitter	2.4	G												
			Level Sensors	2.12.4	G												
			Pipe and Pipe Fittings	2.10.1.1	G												
			Pressure Transmitters	2.12.7	G												
			Pressure Gauges		G												
			Pressure Reducing valves	2.7	G												
			Pressure Relief Devices		G												
			Pumps	2.5	G												
			Storage Tanks	2.4	G												
			Steam Traps		G												
			Temperature Transmitters	2.12.6	G												
			Tube Skid	2.7	G												
			SD-05 Design Data														
			performance data		G												

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		22 72 00.01	pressure loss calculations	2.3.1													
			SD-06 Test Reports														
			test procedures	3.5	G												
			Factory Acceptance Test	3.2	G												
			Point to Point Verification	3.4	G												
			wiring check		G												
			Start-up Test		G												
			HEPA Vent Filter Validation	3.5	G												
			SD-07 Certificates														
			passivation	2.4	G												
			Welders	1.5.2	G												
			welding	1.5.1	G												
			Instrument Calibration	2.12.10	G												
			Certificates														
			SD-08 Manufacturer's Instructions														
			Installation Instructions		G												
			Pre-Start Check-list		G												
			Training Outline		G												
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance		G												
			Manuals														
			spare parts	2.2	G												
		23 40 00.00 10	SD-02 Shop Drawings														
			CBR Air Filtration System	1.6	G AE												
			Installation and Erection	3.1	G AE												

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		23 40 00.00 10	SD-03 Product Data														
			Standard Products	2.1													
			Filtration System	1.6	G AE												
			Filtration Elements	2.4	G AE												
			Isolation Dampers	2.8	G AE												
			Damper Operators	2.8.1	G AE												
			Pressure Gauge	2.11	G AE												
			Quality Assurance Program	2.3													
			Testing Agency	3.7													
			Welding	3.2													
			Acceptance Tests	3.5													
			Factory Tests	2.1.1													
			Field Training	3.8													
			SD-04 Samples														
			Filter Housing	2.3	G AE												
			SD-06 Test Reports														
			Acceptance Tests	3.5													
			SD-07 Certificates														
			Acceptance Tests	3.5													
			Preparation for Shipping	3.6													
			SD-10 Operation and Maintenance Data														
			Filtration Unit Manuals	3.8	G AR												
			Operating and Maintenance Instructions	3.8	G AR												
		26 00 00	SD-02 Shop Drawings														

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		26 00 00	Continuous slot channel	2.2.1	G AE												
			SD-03 Product Data														
			Grounding System	2.1	G AE												
			Continuous slot channel	2.2.1	G AE												
			SD-06 Test Reports														
			Grounding System	2.1													
			Distribution Equipment	3.3													
			SD-07 Certificates														
			Grounding System	2.1													
		26 08 00	SD-06 Test Reports														
			Acceptance tests and inspections	3.1	G DO												
			SD-07 Certificates														
			Qualifications	1.4.1	G DO												
			Acceptance test and inspections procedure	1.4.3	G DO												
		26 20 00	SD-02 Shop Drawings														
			Transformers	2.10	G AE												
			Wireways		G AE												
			SD-03 Product Data														
			Receptacles	2.9	G AE												
			Circuit breakers		G AE												
			Switches	2.7	G AE												
			Transformers	2.10	G AE												
			Enclosed circuit breakers		G AE												
			Manual motor starters		G AE												
			SD-04 Samples														

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		26 20 00	Outlet Boxes for High Containment														
			SD-06 Test Reports														
			600-volt wiring test	3.4.2													
			Grounding system test														
			Transformer tests	3.4.3													
			Ground-fault receptacle test	3.4.4													
			Busway and busway switches														
			SD-07 Certificates														
			Fuses	2.8													
			SD-09 Manufacturer's Field Reports														
			Transformer factory tests	2.16.1													
			SD-10 Operation and Maintenance Data														
			Electrical Systems	1.6.1	G AR												
		26 28 01.00 10	SD-03 Product Data														
			Fault Current Analysis	2.5	G AE												
			Protective Device Coordination Study	2.5	G AE												
			Equipment	2.3.1	G AE												
			System Coordinator	1.4.1	G AE												
			Protective Relays	3.3.4	G AE												
			Installation	3.2	G AE												
			SD-06 Test Reports														
			Field Testing	3.3													



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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASS / REV / ACTION / WORK	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
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		26 28 01.00 10	SD-07 Certificates														
			Devices and Equipment	2.1													
		26 29 23	SD-02 Shop Drawings														
			Schematic diagrams	1.5.1	G AE												
			Interconnecting diagrams	1.5.2	G AE												
			Installation drawings	1.5.3	G AE												
			SD-03 Product Data														
			Variable frequency drives	2.1	G AE												
			Wires and cables	2.3	G AE												
			Equipment schedule	1.5.4	G AE												
			SD-06 Test Reports														
			VFD Test	3.2.1													
			Performance Verification Tests	3.2.2													
			Endurance Test	3.2.3													
			SD-08 Manufacturer's Instructions														
			Installation instructions	1.5.5													
			SD-09 Manufacturer's Field Reports														
			VFD Factory Test Plan	2.4.1	G AE												
			Factory test results	1.5.6													
			SD-10 Operation and Maintenance Data														
			Variable frequency drives	2.1	G AR												
		26 36 00.00 10	SD-02 Shop Drawings														
			Detail Drawings	1.3.3	G AE												
			Equipment	1.3.1	G AE												

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		26 36 00.00 10	SD-03 Product Data														
			Material	1.3.1	G AE												
			Equipment	1.3.1	G AE												
			SD-06 Test Reports														
			Testing	2.4													
			SD-07 Certificates														
			Equipment	1.3.1													
			Material	1.3.1													
			Switching Equipment	1.3.4													
			SD-10 Operation and Maintenance Data														
			Switching Equipment	1.3.4													
			Instructions	3.2													
		26 51 00	SD-01 Preconstruction Submittals														
			Early Submittal Package	1.5	G AE												
			SD-02 Shop Drawings														
			LED lighting fixtures	2.2.1.1	G AE												
			Exit signs	2.10	G AR												
			Emergency lighting equipment	2.11	G AR												
			SD-03 Product Data														
			LED lighting fixtures	2.2.1.1	G AE												
			Exit signs	2.10	G AR												
			Emergency lighting equipment	2.11	G AR												
			SD-04 Samples														
			Finishes	2.6	G AE												
			Lighting Fixtures	2.1	G AE												

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		26 51 00	SD-06 Test Reports														
			Operating Test	3.7													
			SD-10 Operation and Maintenance Data														
			Lighting Fixtures	2.1	G AR												
		27 10 00	SD-02 Shop Drawings														
			Telecommunications drawings	1.6.1.1	G AE												
			SD-03 Product Data														
			Telecommunications cabling	2.3	G AR												
			Modular Copper Cable Patch Panels	2.4.2.1	G AR												
			Patch cords	2.4.2	G AR												
			Telecommunications outlet/connector assemblies	2.5	G AR												
			Connector blocks		G AR												
			SD-06 Test Reports														
			Telecommunications cabling testing	3.3.1													
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1													
			Key Personnel	1.6.2.2													
			Manufacturer Qualifications	1.6.2.3													
			Test plan	1.6.3													
			SD-09 Manufacturer's Field Reports														
			Factory reel tests	2.8.1													

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		27 10 00	SD-10 Operation and Maintenance Data														
			Telecommunications cabling and pathway system	1.10.1	G AR												
			Record Documentation	1.10.2	G AR												
		28 31 76	SD-02 Shop Drawings														
			Wiring Diagrams	3.2.1	G AE F												
			System Layout		G AE F												
			System Operation	2.2	G AE F												
			Initiating Devices		G AE F												
			Notification Appliances	2.13	G AE F												
			Amplifiers	2.11	G AE F												
			SD-03 Product Data														
			Manual stations	2.12	G AE F												
			Batteries	2.10.1	G AE F												
			Smoke sensors	2.9	G AE F												
			Wiring	2.15	G AE F												
			Notification appliances	2.13	G AE F												
			Addressable initiating device circuit interface	2.6	G AE F												
			Amplifiers	2.11	G AE F												
			SD-05 Design Data														
			System Operation	2.2	G AE F												
			Battery power calculations	2.10.1.2	G AE F												
			SD-06 Test Reports														
			Field Quality Control	3.5													

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		28 31 76	Testing Procedures	2.9.3													
			Testing Procedures	3.5.1													
			SD-07 Certificates														
			Installer	1.5.1.4													
			SD-09 Manufacturer's Field														
			Reports														
			Fire Alarm/Mass Notification	1.5.3.2													
			System														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.7.1	G AR												
			Instructions														
			Instruction of Government		G AR												
			Employees														
		31 00 00	SD-05 Design Data														
			Shoring and Sloping	3.11	G ED												
			Dewatering	3.7.2	G AR												
			Discontinuing Dewatering		G AR												
			Notification														
			Dewatering Plan	3.7.2.3	G ED												
			Blast Monitoring Plan	3.9.5.3	G ED												
			Pre-blast Survey	3.9.5.2	G AR												
			Blasting Schedule	3.9.6	G AR												
			Seismograph	3.9.5.3	G AR												
			Blasting Safety Plan	3.9.5.4	G ED												
			Post Blast Reconnaissance	3.9.5.5	G ED												

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		31 00 00	Blast Records	3.9.7													
			SD-06 Test Reports														
			Core Borings	3.5.1	G ED												
			Basement Subgrade Inspection	3.5.3													
			Notification														
			Testing	3.24													
			Rock	3.3													
			Mix Design	3.6.4	G ED												
			Records	3.6.4	G ED												
			SD-07 Certificates														
			Testing Lab	3.24													
			Qualifications	3.6.2													
			Flowable Fill	3.24.6	G ED												
			Flowable Fill	3.24.6	G ED												
		40 17 26.00	SD-02 Shop Drawings														
			Welding pressure piping	1.5.1													
			SD-07 Certificates														
			Welding procedures qualification	1.5.3													
			Nondestructive examination	1.5.2													
			(NDE) procedures														
			NDE personnel certification	1.5.6.2													
			procedures														
			Inspector certification	1.5.6.1													
			SD-11 Closeout Submittals														
			Weld identifications	1.5.7.1													

SECTION 01 33 16.00 10

DESIGN DATA (DESIGN AFTER AWARD)

05/16

PART 1 GENERAL

1.1 SUMMARY

After award, develop the accepted proposal into the completed design, as described herein. Use a collaborative, integrated design process for all stages of project delivery with comprehensive performance goals for site development, energy, water, material selection, indoor environmental quality, and waste diversion. Ensure incorporation of these goals in project delivery. Consider all stages of the building lifecycle, including deconstruction, rehabilitation, re-purposing, or demolition.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP

(2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 19005-3

(2012) Document Management -- Electronic Document File Format for Long-Term Preservation -- Part 3: Use of ISO 32000-1 with Support for Embedded Files (PDF/A-3)

ISO 32000-1

(2008) Document Management -- Portable Document Format -- Part 1: PDF 1.7

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13

(2022; ERTA 1 2021) Standard for the Installation of Sprinkler Systems

NFPA 70

(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 72

(2022) National Fire Alarm and Signaling Code

NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS)

NBIMS-US (V3) National BIM Standard - United States

NCS (V6) United States National CAD Standard

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-2909 (2012) Engineering and Design --  
Geospatial Data and Systems

ERDC/ITL TR-19-6 (2019) A/E/C Graphics Standard, Release 2.1

ERDC/ITL TR-19-7 (2019) A/E/C CAD Standard - Release 6.1

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-02 (2020; with Change 1, 2020) High  
Performance and Sustainable Building  
Requirements

UFC 1-300-02 (2014; with Change 3, 2021) Unified  
Facilities Guide Specifications (UFGS)  
Format Standard

UFC 4-010-01 (2018; with Change 1, 2020) DoD Minimum  
Antiterrorism Standards for Buildings

UFC 4-023-03 (2009; with Change 3, 2016) Design of  
Buildings to Resist Progressive Collapse

1.3 DEFINITIONS

1.3.1 Designer of Record (DOR)

Professional Registered members of the Contractor's Design-Build team that check, approve, sign, date, and certify, prior to submitting the deliverables to the Government, that the D-B design submittals comply with the contract requirements.

The DOR's stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage. The DOR(s) are responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-built condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional design responsibilities.

1.3.2 Design Freedom

The conceptual level (approximately 35%) drawings attached to the specifications provide floor plan and effluent decontamination system (EDS) system layout, as well as layout of supporting systems and utilities, to convey the design intent with respect to redundancy, operational, and maintenance requirements and are to be used as the basis of design for design progression to 100% design. Not all



necessary/required components are shown. The contractor's design engineers and architects of record are responsible for providing a complete coordinated design that meets all of the requirements of the contract. Revision or modification of indicated building plans, equipment layout and forms shall only be allowed with government approval and users' operability requirements are accommodated as per the contract.

#### 1.3.3 Government Furnished Material (GFM)

Government material that may be incorporated into, or attached to, an end item to be delivered under a contract or which may be consumed in the performance of a contract. It includes, but is not limited to, raw and processed material, parts, components, assemblies, and small tools and supplies.

#### 1.3.4 Advanced Modeling

A subset of geospatial technologies as defined in EM 1110-1-2909 to include BIM, CIM, GIS, and CAD. Advanced Modeling is comprised of models and drawings that form a digital representation of the project, or part thereof, that are comprised of model elements with facility data.

#### 1.3.5 Model Element

A self-contained graphical element with a unique identification that is used to populate a model, and whose behavior and properties are defined by facility/site data and software processes. Model elements can represent a physical entity, such as a pump, a concrete wall, or a utility vault and range from the simple to the complex and can be custom modified.

#### 1.3.6 USACE Minimum Modeling Matrix (M3)

The USACE Minimum Modeling Matrix (M3) describes the minimum modeling and data requirements by defining the level of development (LOD) and element grade.

#### 1.3.7 Facility Data

Non-graphical data attached to surface and subsurface components for both building and site model elements that describe various facility characteristics such as parametric values that drive physical sizes, material definitions (e.g. wood, metal), manufacturer data, industry standards (e.g. AISC steel properties), location, and project identification numbers. Facility data can also define supplementary physical entities that are not shown graphically in the model, such as the system of a duct, hardware on a door, content of conduit, site surface, alignment, levee, channel or transformer properties.

#### 1.3.8 Industry Foundation Class (IFC)

IFC are a standard and file format used for the exchange of model elements and data; see <http://www.iai-tech.org>. In the context of this section, IFC does not mean "Issued For Construction."

#### 1.3.9 Model Uses

A Model Use is a method or strategy of applying modeling during a facility's life cycle to achieve one or more specific objectives. Reference NBIMS-US for the definitive list of Model Uses and definitions.

### 1.3.10 USACE BIM/CIM Platform Configuration Standards - Templates, Workspaces, Catalogs, and Environments

#### 1.3.10.1 USACE Revit Templates

The USACE Revit templates are discipline specific and include family content pertinent to that discipline. The templates share standard symbology such as annotation families, line styles, and text styles. The templates include pre-defined shared parameters.

#### 1.3.11 USACE CAD/BIM Technology Center

The USACE CAD/BIM Technology Center hosts all standard content for USACE. This content can be accessed through the CAD/BIM Technology Center website, .

### 1.4 ORDER OF PRECEDENCE

In the event of a conflict or inconsistency between any of the requirements within the Contract, precedence is applied:

- a. Any portions of the accepted proposal which both conform to and exceed the requirements of the solicitation.
- b. The provisions of the solicitation. Follow specifications included in the solicitation prior to standard UFGS specification sections.
- c. All other provisions of the accepted proposal.
- d. Any design products including, but not limited to, plans, specifications, engineering studies and analyses, shop drawings, and equipment installation drawings. These are "deliverables" under the contract are not part of the contract itself. Design products must conform to all provisions of the contract, in the order of precedence.

### 1.5 PRECONSTRUCTION ACTIVITIES

#### 1.5.1 Design Quality Control Plan

Submit a Design Quality Control Plan in accordance with Section 01 45 00.00 10 QUALITY CONTROL before design may proceed.

#### 1.5.2 Meetings and Conferences

##### 1.5.2.1 Post Award Conference

The Government will conduct a post award conference at the project site , as soon as possible after Contract award, coordinated with issuance of the notice to proceed (NTP). Participation by the Contractor and major subcontractor representatives is mandatory. All designers shall attend this first meeting. The government will provide an agenda, meeting goals, meeting place, and meeting time to participants prior to the meeting.

As a minimum the following will be addressed during the conference: determination and introduction of contact person and their authorities; contract administration requirements; discussion of expected project progress processes; and coordination of subsequent meeting.

- a. The government will introduce the Government project delivery team members, facility users, facility command representatives, and installation representatives.
- b. Introduce key personal, major subcontractors and other needed staff.
- c. Define expectations and duties of each participant.
- d. Develop a meeting roster with complete contact information including name, office, project role, phone, mailing and physical address, and e-mail address for distribution to all participants. Also, provide minutes of the meeting to all participants.
- e. The Government will define the risk analysis assessment and quality assurance as defined in Draft RFP under Section 22 72 00.01 EFFLUENT DECONTAMINATION SYSTEM.

#### 1.5.2.2 Initial Design Conference

After Contract award, conduct the initial design conference, and provide a record of the meeting. All Designers of Record must participate in the conference. The primary purpose of the meeting is to make sure any needs are assigned and due dates established, as well as points of contact identified. The initial design conference may be scheduled and conducted at the project installation after the Post Award Conference and prior to initiation of significant preliminary design development, although it is recommended that the partnering process be initiated at the time of or before the initial design conference. Limit any design work conducted after award and prior to this conference to site work.

#### 1.5.2.3 Advanced Modeling Kick-Off Meeting

Conduct an Advanced Modeling Kick-Off Meeting prior to submission of the Advanced Modeling PxP, within 45 days after Notice to Proceed. Required meeting attendance includes, at a minimum, the DOR, the design drawing and modeling specialist and the Geographic District BIM Manager or delegate.

The intent of this meeting is to coordinate the expectations for the Advanced Modeling PxP.

#### 1.5.2.4 Advanced Modeling PxP Demonstration Meeting

Within 30 days after the acceptance of the Advanced Modeling PxP and M3, conduct a demonstration to review the Plan for clarification, and to verify the functionality of planned Model technology workflow and processes. If modifications are required, complete the modifications and resubmit the Advanced Modeling PxP performing a subsequent demonstration for Government acceptance.

#### 1.5.2.5 Pre-Construction Conference

Before starting any construction activities, jointly conduct an administrative conference with the Government to discuss any outstanding requirements and to review local installation requirements. It is possible there will be multiple Pre-Construction Conferences based on the configuration of the design packages. Provide minutes of the meeting(s) to all participants.

## 1.6 SUBMITTALS

Each submittal includes an associated approval level designation as defined in the following table:

Approval Level Designation	Definition
G	Government approval
no designation	for information only
D	Designer of Record approval
C	Government Conformance Review of Design
R	Designer of Record Approval and Government Conformance Review
A	Designer of Record Approval and Government Approval
S	inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING

When used, a designation following the approval level designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Advanced Modeling Project Execution Plan (PxP); C

Design Quality Control Plan; G

Initial Design Conference

Preconstruction Conference

DCM Procedures; G

Submittal Register; G

Risk Assessment; G

## SD-05 Design Data

Design and Code Checklists; C

Sustainable Design; C

Equipment Mock Up Definition and Review Procedures

Interim Design Submittals; R

Interior And Exterior Building Finishes Scheme; G

Furniture, Fixtures & Equipment; G

Conference Documentation

Final Design Submittals; R

Design Complete Documents; C

SD-11 Closeout Submittals

DD Form 1354; A

## 1.7 RISK ASSESSMENT

The vendor shall establish an approved agenda, and conduct a detailed risk analysis for the EDS system during the DB design phase. The Risk Analysis shall review multiple aspects of the design, and shall gain USACE approval of those aspects listed as fully fulfilling the USACE functional needs. At a minimum, the risk analysis shall a) gain approval on PFD components and function, b) gain approval on the manner which service of all components occur, and how the isolation of components and lines are provided for to enable those activities, review and gain approval on the EHS (environment, health & safety) / injury to personnel risks, the ergonomics, and full alignment with User protocols. These risks shall include failure types, upset conditions (containment, leak, and similar) and risks to reliability or 'up time' status. Risk Analysis shall be performed in two phases, once when the design is at 45% completion, and again more thoroughly when the design is between 60 to 70% completion. Both shall include 3D model reviews for both the EDS skid, and all EDS reliant infrastructure in the room(s) where the EDS components will be installed. Risk assessment should evaluate secondary upset conditions, and safety and regulatory/operational compliance based containment consistent with BSL 4 organisms handled by the EDS system. Submit full assessment report and 3D model of EDS system for Government review for each phase (45% completion and 60-70% completion).

## 1.8 DESIGN QUALITY CONTROL

### 1.8.1 Design And Code Checklists

Develop and utilize appropriate discipline-specific checklists during the design and quality control of each submittal. Submit these completed checklists with each design submittal, as applicable, as part of the project documentation. See Section 01 45 00.00 10 Contractor Quality Control and paragraph FIRE PROTECTION AND LIFE SAFETY CODE REVIEW for a sample Fire Protection and Life Safety Code Review checklist.

### 1.8.2 Advanced Modeling Project Execution Plan (PxP)

Develop an Advanced Modeling Project Execution Plan ("Plan" or "PxP") documenting mandatory and Contractor-elected BIM Uses, analysis technologies and workflows. Submit the PxP within 45 days after issuance of Notice to Proceed.

Use the USACE ADVANCED MODELING PROJECT EXECUTION PLAN (PxP) Template located at the USACE CAD/BIM Technology Center website to develop an acceptable Plan and update to include platforms and processes to meet the requirements of the project.

## Repair Steam Sterilization Plant (SSP)

### 1.8.2.1 M3 Template

Use the M3 Template located at the USACE CAD/BIM Technology Center website and submit as part of the Advanced Modeling PxP.

### 1.8.2.2 Model Uses

Mandatory Model Uses are predefined in the Project Execution Plan (PxP) and cannot be modified. Identify additional elected Model Uses in the PxP.

## 1.9 DELIVERY, STORAGE, AND HANDLING

### 1.9.1 Electronic Design Submittal

Provide identical copies of discs for approval, for each submittal required. Provide quantities and sizes indicated in the distribution list at the end of this specification section. Provide submittal files on electronic storage media and format to be downloaded to a DoD secure site provided by the government at the time of award in compliance with the quality requirements identified in this specification. Follow Department of Defense Secure Access File Exchange (DoD SAFE) User Guide, version 0.2d, dated 9/4/2019.

#### 1.9.1.1 Malicious Content

Scan all electronic files for malicious viruses using commercially available scanning program that is routinely updated to identify and remove current virus threats.

#### 1.9.1.2 Storage Media

Provide project data on disc-based (DVD±R/RW) media and provide data to a DoD secure site provided by the government at the time of award. Provide the full submittal on one single whenever possible. When separation of the submittal is required separate deliverables onto separate media. Document any media and electronic file divisions in the PxP for approval by the Contracting Officer.

- a. Directly print identification of contents onto storage media. Do not provide adhesived labels. Include the name of the submittal, project, project location, Contract number, Designer of Record firm/Prime Contractor company's name, title of submission, and security classification (in accordance with the applicable security classification labeling regulations) on the label. If multiple discs are provided, clearly document the contents of each disc on the label.
- b. Include the name and contact information of the individual who produced the final data disc to ensure that any problems with the data or media can be easily resolved.
- c. When browsed on any computer, the disc displays the following folders and their associated content:
  - (1) Submittal files (containing all submittal data)
  - (2) All supporting documents associated with the submittal
  - (3) Readme containing one TXT, PDF, or HTML file with general use information, organizational instructions, and basic preparer

contact information.

#### 1.9.2 Advanced Model File Packaging

Execute the following actions for all design drawing and modeling files:

##### 1.9.2.1 Autodesk Revit, Civil3D, AutoCAD

- a. Purge unused
- b. Audit
- c. Compress

#### 1.9.3 PDF File Packaging

Utilize PDF file format in accordance with ISO 32000-1 and ISO 19005-3. Provide files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution whenever possible.

##### 1.9.3.1 Bookmarking

- a. Bookmark drawing submittal PDF sets to include one Parent Bookmark per Discipline and one Child Bookmark per sheet within each Discipline. Format Parent Bookmarks as "Discipline" (e.g. Architectural). Format Child Bookmarks as "Sheet ID Sheet Title" (e.g. A-101 First Floor Plan).
- b. Bookmark specification submittal PDF sets using the SpecsIntact Print Processing PDF Print/Publish feature, combining processed sections into one PDF document. Insert the Submittal Register into the file where specified by Section 01 33 00 SUBMITTAL PROCEDURES and bookmark.
- c. Bookmark design analysis and calculation submittal PDF sets to include one Parent Bookmark per design analysis section and one Child Bookmark per major paragraph per section. Format Parent Bookmarks as "Section" (e.g. Architectural). Format Child Bookmarks as "major paragraph designation Sheet Title" (e.g. 2.1 Primary Facility Functions).

#### 1.9.4 Hardcopy Design Submittal

Print hard copy submittals directly from the electronically packaged PDF files. Provide quantities and sizes as indicated in the distribution list at the end of this specification section .

The Designer(s) of Record stamps and signs the original full size hard copy sheets as Released For Construction. Provide distribution from this set.

## PART 2 PRODUCTS

### 2.1 GOVERNMENT FURNISHED MATERIALS

The Government will provide Advanced Modeling files as GFM for use in design development. Develop and maintain the information and level of detail contained in the GFM in the Project design, as required by this Contract.

The Contractor has the option of preparing their own Advanced Modeling

files in the formats prescribed as a basis for design, design drawings, and interim design submittals. If so, maintain the same level of detail, properties, and functionality in the models that is prescribed in this specification.

#### 2.1.1 GFM Handover

The Government will provide the GFM at Contract Award.

#### 2.1.2 GFM File Formats

GFM are provided in the following file formats:

##### 2.1.2.1 Government Furnished BIM

The GFM includes Autodesk Revit, Version 2021.

##### 2.1.2.2 Government Furnished CIM

The GFM includes Autodesk Civil3D, Version 2021.

##### 2.1.2.3 Government Furnished CAD

The GFM includes Autodesk AutoCAD, Version 2018.

#### 2.1.3 Advanced Modeling Completion and Quality

The Government makes no guarantee that the BIM/CIM models, GIS data, CAD files and Facility Data provide the level of completeness or quality required for a submittal. Develop or update files and data to completely and correctly represent the as-built conditions of the facility and the site.

However, use of any Government Furnished BIM, CIM and GIS for creation of contract submittals is at the Contractor's own risk. Any quality control issues discovered in the GFM do not absolve the Contractor from submitting contract compliant deliverables as described in this and other specifications.

#### 2.1.4 Data Loss, Corruption, and Error

Use of GFM files is at the Contractor's risk. Verify data integrity upon receipt and request a replacement if necessary.

Any adjustment of file structure, format, or software version required to make GFM compatible with computer systems and/or software is the responsibility of the Contractor.

#### 2.2 ADVANCED MODELING PACKAGE

Provide all of the following documents with each design submittal.

##### 2.2.1 Submitted Files List

Provide list of all submitted electronic files including a description, directory, and file name for each file submitted. Identify which files have been produced from the Model and Facility Data. For all Sheet files, include a list of the sheet titles and sheet numbers.



### 2.2.2 Advanced Modeling Submittal Checklist

Complete the USACE BIM/CIM Advanced Modeling Submittal Checklist and include with each submittal. Download the Checklist from the USACE CAD/BIM Technology Center website.

### 2.2.3 Advanced Modeling Electronic Files

Include all Advanced Modeling files associated with the contract scope of work.

#### 2.2.3.1 3D Interactive Review Model

Provide a copy of each BIM and CIM Model in an approved interactive review format. Use Autodesk Navisworks version 2021 for the 3D Interactive Review Model format.

#### 2.2.3.2 Industry Foundation Class (IFC) Coordination View

Provide an IFC Coordination View for all deliverables. Provide exported property set data for all IFC supported named building elements. Submit all IFC models in the IFC2x3 Coordination View V2.0 schema.

#### 2.2.3.3 Quality Control (QC) Reports

As a minimum, include the following reports as separate reports and files.

##### 2.2.3.3.1 Model Standards Checks and Reports

Provide QC checks demonstrating adherence to the NCS v6.0 BIM Implementation section. Identify and report non-compliant elements and submit a corrective action plan. Provide the Government with detailed justification and request Government acceptance for any non-compliant elements that the Contractor proposes to be allowed to remain in the Model. Verify the following for the Model(s) and Facility Data set:

- a. No undefined, incorrectly defined, or duplicated elements.
- a. No errors when opening.
- c. No broken Links, References, or X-References.
- d. Minimized extraneous information.
- e. Content uses the coordinate system defined in the approved PxP.
- f. Models share a common alignment point.
- g. For a Design Complete or Record Submittal; no unloaded Links, References, or X-References exist.

##### 2.2.3.3.2 Graphics Standards Checks and Report

Provide QC checks on all graphic deliverables demonstrating that the fonts, dimensions, symbology and other construction document formatting are compliant with the requirements of this specification. Identify and report non-compliant content.

#### 2.2.3.3.3 CAD Standards Checks and Report

Provide QC checks on CAD Output demonstrating that filenames, sheet borders, layer/level names, and symbology are compliant with the requirements of this specification. Identify and report non-compliant content.

#### 2.2.3.3.4 Interference Management (3D Coordination) Checks and Report

Execute Interference Management checks and provide a summary of the results noting total hard interferences (e.g., mechanical vs. structural, or mechanical vs. mechanical, overlaps in the same location) and soft interferences (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation, code space requirements).

#### 2.2.3.3.5 Additional Parameters

Additional QC parameters as deemed appropriate for the Project may be developed and documented in the Advanced Modeling PXP.

#### 2.2.4 Advanced Modeling Re-Submittals

If components of an Advanced Modeling submittal are rejected, provide the following for each Advanced Modeling Re-Submittal, in addition to re-submittal information required by Section 01 33 00 SUBMITTAL PROCEDURES:

- a. Re-submit all components required under paragraph ADVANCED MODELING PACKAGE, including a new Advanced Modeling Checklist and updated content in response to Government comments.
- b. Provide a copy of all Government review comments.
- c. Provide a response to each Government review comment for back check.

Upon resubmission, all BIM related documents, including the PXP shall be resubmitted.

### 2.3 DESIGN DRAWINGS

From advanced model files, produce design drawings that describe the scope of the Contract for all required submittals including all interim and final deliverables.

#### 2.3.1 Electronic Drawing Files

Provide electronic drawing files in PDF format for each project drawing in the design set.

#### 2.3.2 Drawing Index

Provide an index of drawings sheet as part of the drawing set, and an electronic table of all drawings submitted. Include the electronic file name, the sheet reference number, the sheet number, and the sheet title containing the data for each drawing.

#### 2.3.3 Shop Drawings Used as Design Drawings

Design drawings may be prepared similar to shop drawings to minimize construction submittals after the Design Complete Submittals. Prepare and

submit with the design drawings, appropriate connection, fabrication, layout, and product specific drawings.

#### 2.3.3.1 Drawing Format For Shop Drawings Used as Design Drawings

Use the Contractor-originated drawings as the basis for the record drawings. Conform shop drawings included as design documents with the same drawing requirements such as drawing format, sheet size, layering, lettering, and title block used in design drawings.

#### 2.3.3.2 Identification of Shop Drawings Used as Design Drawings

Indicate which shop drawings are being submitted as design drawings in the transmittal letter.

#### 2.3.4 Seal on Documents

Sign, date and seal all Contractor-originated design drawings by the registered architect or the registered engineer of the respective discipline. This is the seal of the Designer of Record for that drawing. Application of the electronic seal and signature accepts responsibility for the work shown thereon.

### 2.4 SPECIFICATIONS

Provide a Contractor-originated design specification that, in conjunction with the drawings, demonstrates compliance with materials, equipment, execution, and field quality control requirements of the RFP and accepted proposal.

#### 2.4.1 Specifications Format

Utilize the Unified Facility Guide Specifications (UFGS) current at the time of Contract award. Process the specifications with the SpecsIntact software package.

- a. Edit and expand the appropriate specifications to ensure that all project design requirements, current code requirements, and regulatory requirements are met. Provide non-proprietary, descriptive project specifications in compliance with the requirements in UFC 1-300-02. Do not provide proprietary information in the project specifications unless approved by the Contracting Officer.
- b. Note that the UFGS are based on design-bid-build contracting and will require editing to apply to a design-build project. For instance, they assume that the Government will approve most submittals, whereas in design-build, the DOR has that action, unless this solicitation requires Government approval for specific submittals.
- c. Organize project sections not based on UFGS in accordance with CSI MasterFormat and UFC 1-300-02.

#### 2.4.2 Identification of Manufacturer's Product Data Used as Specifications.

Provide complete and legible catalog cut sheets, product data, installation instructions, operation and maintenance instructions, warranty, and certifications for products and equipment for which final material and equipment choices have been made. Indicate, by prominent notation, each product that is being submitted including optional

manufacturer's features, and indicate where the product data shows compliance with the Contract requirements.

#### 2.4.3 Specifications Packaging

Provide specifications to include the following:

- a. Cover sheet and project table of contents.
- b. Specification sections, each section with a table of contents.
- c. The specifications provided with this solicitation establish minimum requirements for 'Specified Criteria'; these Specified Criteria include salient features, ratings, detailing of assemblies and installations, criteria, performance, capacities, compliance with standards and guidelines, and numerous other attributes cited throughout these solicitation specifications and the work.

These 'Specified Criteria' include the solicitation specifications proper, and all requirements stated elsewhere throughout the solicitation (such as in the solicitation Chapters, narratives, and those illustrated through functional arrangements shown on concept design drawings). The Architect and Engineer of Record, and the manufacturers of systems and assemblies provided shall apply all Specified Criteria to their work, and generate a project specific set of technical specifications compliant with these criteria in full, for USACE review and approval prior to fabrication. All variances from the specified criteria shall be independently listed for USACE review and decision of acceptance or rejection to revert back to the specified criteria without cost to USACE.

The solicitation specifications shall be used in a manner similar to UFC criteria; they describe the minimum criteria for the work, and application of quality, arrangements, installation detailing, and intended outcomes for that work. As the Design Build construction drawings and specifications are developed for USACE review and approval, the specifications may be found to include some language and components which are not needed in the USACE approved detailed design solution and contract documents generated by the Architect and Engineer of Record and the manufacturers of systems and assemblies. Where this occurs to work approved by USACE, those elements of the Specified Criteria will have been made extraneous through the specifics of the Design Build design.

- d. Manufacturer's Product Data. If providing as attachments to the applicable specification section, incorporate as attachment reference within the section and section table of contents.

#### 2.4.4 Specification Deliverable

Submit a bundled specification package in PDF format for each design package. As a minimum, bookmark each specification section in the bundled package. Also, submit the source files, in the processing system format, used to create the PDF.

### 2.5 DESIGN ANALYSIS

Prepare, organize, and present a design analysis that will document the general parameters, functional and technical requirements, design

objectives, design assumptions, and provides design calculations applicable to a project's design. Organize the design analysis into three parts; Part 1 - General Description; Part 2 - Design Requirements and Provisions; and Part 3 - O&M Provisions.

The design analysis states the purpose, authorization, applicable criteria and the project description for the project, and provides a summary of the factors influencing the choice of the civil, environmental, architectural, structural, mechanical, electrical, communications, fire protection, physical security systems, HTRW, and sustainable design features used in the project along with an indication of how the initial costs were factored into final selections. In the final design analysis clearly and succinctly include:

- a. An introductory description of the project concepts that addresses the salient points of the design
- b. An orderly and comprehensive documentation of criteria and rationale for system selection.
- c. The identification of any necessary licenses and permits that are anticipated to be required as a part of the design and/or construction process.
- d. Identify all applicable codes and criteria and highlight specific requirements within these codes and criteria for critical issues in the facility design.
- e. Required calculations as specified and as needed to support the design.
- f. Clearly identify "Sustainable Design" features that address high performance and sustainable building (HPSB) concepts as required by UFC 1-200-02. Sustainable design documentation must support Guiding Principles Validation and Third Party Certification (TPC) requirements in Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING to include HPSB and TPC checklists.
- g. Clearly identify "Antiterrorism" requirement and document the antiterrorism and force protection features as required by UFC 4-010-01.

#### 2.5.1 Design Requirements and Provisions

Include subparts for each major design discipline and basic project design requirements for each discipline that justify and validate design decisions. See submittal requirements paragraphs for discipline specific items. Also include items below that span multiple disciplines.

#### 2.5.2 Design Analysis Packaging

##### 2.5.2.1 Assembly and Identification

Assemble design analysis in a single volume with a table of contents if possible. Include a cover page in the basis of design for each discipline indicating the project title and locations, contract number, table of contents, and tabbed separations or bookmarks for quick reference. At a minimum tab or bookmark for each discipline.

### 2.5.3 Calculations

Place the signature and seal of the designer of record responsible for the work on the cover page of the calculations for the respective design discipline.

## PART 3 EXECUTION

### 3.1 DESIGN SUBMITTALS

Include all deliverable products and associated support documents described in Part 2 of this specification with each design submittal.

### 3.2 DESIGN SUBMITTAL PHASES

The stages of design submittals described below define requirements with respect to process and content. Determine how to best plan and execute the design and review process for the project, within the parameters listed below. At the time of proposal, submit layout at 15-30% completion. As a minimum, provide at least one design submittal at 50% completion, evolving and developing the level of detail from the proposal; one design submittal at 75% completion, which shall include the Final EDS System early procurement; one design at 95% completion for draft final; and one design submittal at 100% with backcheck incorporated. There must be a review meeting for each design submission and all review meetings must be held at Ft. Detrick at a site designated by the Contracting Officer.

#### 3.2.1 Interim Design Submittals

Submit a Concept (35%) and Preliminary (65%) for review, representing complete packages with all design disciplines. This is not necessarily a hold point for the design process; the Contractor may designate the interim design submittal(s) as a snapshot and proceed with design development at its own risk.

##### 3.2.1.1 Interim Design Development Management

Maintain a fully functional configuration management system as described herein to track design revisions, regardless of whether or not there is a need for a formal interim design development review.

##### 3.2.1.2 Over-the-Shoulder Progress Review

To facilitate a streamlined design-build process, the Government and the Contractor may agree to one-on-one review or small group reviews, on-line, or at the Contractor's design offices or other agreed location, when practicable to the parties. Coordinate such reviews to minimize or eliminate disruptions to the design process. Due to limits on project funding, utilize the maximum virtual teaming methods. Facilitate these reviews with electronic format data transfer and collaboration. Through the partnering process, find ways to facilitate the quality assurance process and to facilitate meeting or bettering the design-build schedule.

#### 3.2.2 Concept (35%) Design Submittal

The review of this submittal is primarily to ensure that the contract documents and design analysis are proceeding in a timely manner and that the design criteria are being correctly interpreted. The design submittal shall contain, as a minimum, the following:

### 3.2.2.1 Geotechnical

The geotechnical report should be a complete stand alone document and shall be stamped and signed by a registered professional engineer (P.E.), specializing in geotechnical engineering consultation and having experience in the project's geographical region. The report shall address all the geotechnical requirements and shall include descriptions/details of the following:

- a. Project Location
- b. Project Description: The type of structures (number of stories, type of construction (steel, concrete, masonry), basement, slab-on-grade, pavement types, etc.
- c. Site Description: Topography, grassed, paved, existing structures etc.
- d. Site Investigation:
  - (1) Subsurface investigation: The number and depth of drill holes, test pits, CPTs etc. The type of drilling method used (SPT, auger, wash boring, rock coring etc.). A subsurface exploration plan should be included as an appendix showing the location of all borings, test pits, CPTs etc. Final boring logs shall be included as an appendix to the report and they shall also be shown on the contract drawings. Include soils profiles if available.
  - (2) Laboratory Testing: The number and type of tests performed. Test results shall be provided as an appendix to the report.
- e. Subsurface Conditions:
  - (1) Regional Geology: A description of the regional geology at the project site.
  - (2) Soil Stratigraphy: A discussion of the different soil types and layers encountered, consistency and Standard Penetration Test (SPT) blow counts specific to the project site.
  - (3) Bedrock Stratigraphy: A discussion of the different rock layers, types, quality, RQD, etc.
  - (4) Groundwater: Discuss groundwater depths encountered and discuss any impacts it will have during construction.
- f. Foundation Design: Include applicable references used and assumptions made in the foundation analysis. Include design structural loads and allowable settlements. Provide allowable soil/rock bearing capacity, minimum and maximum footing sizes or type and sizes of deep foundation elements and magnitude of anticipated settlements. Calculations to support the foundation recommendations shall be included as an appendix.
- g. Pavement Design: Include applicable references used and assumptions made. Provide information of the type of traffic (type and frequency of vehicle passes) anticipated on the pavements and the subgrade type and strength used in the analysis. Provide recommended final pavement sections and indicate what design method (strength, Frost reduced

subgrade strength, frost limited subgrade frost penetration method) it was based on. Discuss pavement subdrainage.

- h. Earthwork: Discuss what soils are considered satisfactory and unsatisfactory for fill and backfill for buildings, paved areas and overlot areas. Indicate the compaction and moisture control requirements and by test methods it will be compared to (standard proctor, Modified Proctor). Indicate if subgrade/soil stabilization will be required. If stabilization is required, discuss the method of stabilization.
- i. Include a discussion with supporting documentation on any other related geotechnical matter that is necessary as a part of this contract (i.e., slope stability, Mechanically Stabilized Earth (MSE) walls, etc.).
- j. Details: Include any foundation and pavement details that would enhance or clarify the design recommendations.

#### 3.2.2.2 Site Development

- a. Design Analysis: A narrative description of siting requirements and design rationale for buildings, roads, streets, parking facilities, grading, earthwork, utilities, stormwater management, landscaping, ATFP and security and other related site aspects shall be provided. All references and guidance used to develop the design shall be indicated, including installation, DoD, Army, federal, utility owner, and local requirements. The design analysis shall address the following:
  - (1) Existing Conditions: Describe the pre-project site conditions including location, land use, previous land use, topography, drainage and hydrology, soils, utilities, and natural resources.
  - (2) Site Improvements: Describe demolition requirements, site design rational for site improvements including layout, grading and drainage, earthwork, roads and parking, pedestrian circulation, proposed utilities, landscaping, and site ATFP security features.
  - (3) Utilities: Present utility systems analysis and design.
    - (a) Storm Drainage: Present the design of all new storm drainage and an analysis of the existing storm drainage to which the new will be connected, if applicable.
    - (b) Roof Drainage: The roof drainage system shall be designed in accordance with the National Plumbing Code. Present roof drainage concept design coordinated with architectural plan.
    - (c) Sanitary Sewers: A description of existing and proposed sanitary sewer facilities and supporting design computations shall be provided.
    - (d) Water Service: A description of existing and proposed water service for the proposed facility shall be provided. Adequacy of existing system and additions required to properly service and provide fire protection for the new facility should be included.
  - (4) Erosion and Sedimentation Control and Stormwater Management: A



description of erosion and sediment control and storm water management requirements, conceptual design, and permit requirements shall be provided.

- (5) Environmental: Include an impact assessment checklist covering air, water and noise effects from the project and construction; worker health and safety; HTRW remediation cleanup and action levels; transportation and disposal regulation requirements; quality control for chemical sampling/analysis; wetlands determination (tidal and nontidal); special wildlife, plant, and endangered species considerations; ground water, waterway and floodplain protection assessment; pollution prevention control requirements; and design measures to be implemented (i.e., construction site sediment and erosion control requirements by Federal, state and local governments); and hazardous material management, natural and cultural resources, and environmental permits.
6. Landscape: The landscape planting design narrative shall describe the analysis of existing site conditions, including an indication of existing plant materials that are to remain on the site. The statement of concept shall indicate specific site problems related to proposed development and the rationale for proposed plant locations. The narrative shall also include a list of suggested types and sizes of plant materials which are to be used, based upon the designated functional and visual criteria.

b. Drawings should include:

- (1) Survey Plan: Existing conditions drawing showing performed topographic survey. Plan shall show all existing site features and utilities. Identify source of mapping and include survey benchmarks and tie-downs, and existing utility structure data collected during field investigation. Existing topography, including contours with sufficient spot elevations to establish existing ground surface in high and low areas. Include location and vicinity map.
- (2) Demolition Plan: Items to be removed, abandoned and relocated shall be clearly indicated with a legend and keyed notes. An asbestos and lead paint survey shall be conducted where demolition work is required.
- (3) Layout Plan: Plan shall include all new site features with appropriate labels and dimensions for all new features shall be shown. Base lines used to lay out the new work shall be clearly identified. The use of coordinates for locating new features is acceptable, but base line layouts are preferable. Do not show utilities except surface structures or topography on this plan. Show stormwater management outlines. Show required standoff distances, if applicable.
- (4) Grading and Drainage Plan: A grading plan shall be provided including:
  - (a) Show existing topography contours. Show existing site features and storm drainage. All site features shown to be removed on demolition plan shall not be shown on this drawing.

(b) New buildings, roads, parking facilities, site features etc. shall be shown.

(c) New grading including the finish floor elevations for all new buildings and other structures with contours and spot elevations in sufficient detail to develop the drainage pattern as well as earthwork quantities.

(d) Locations of all inlets, storm and sanitary manholes, water valve, electric and communication manholes and all other utility structures visible at grade on the plan shall be indicated. Proposed utility lines shall not be shown except storm drain infrastructure.

(e) Show proposed stormwater management areas with proposed grading.

- (5) Utility Plan: All existing utilities to remain and new utilities shall be shown, including but not limited to sanitary sewers, force mains, water lines, storm drainage, roof drains, gas lines, subdrainage, and foundation drains. Electrical and communication lines may be shown on this drawing or reference the electrical utility plan. All new and existing to remain buildings, roads, parking areas, site features shall be shown. Contours and spot elevations shall not be shown. The plan shall clearly present:

(a) Existing and new sanitary sewers and force mains including manhole and cleanout locations. Size of all sanitary sewers and force mains should be shown.

(b) Existing and new water distribution and service lines, including valve and fire hydrant locations. Sizes of all service and distribution lines shall be shown.

(c) Existing and new storm drainage system and roof drainage with inlets, manholes, and headwalls indicated. Size of storm drains should be shown.

(d) Existing and new steam and/or gas distribution and service lines including valves.

(e) All utilities to remain, to be abandoned or relocated.

(f) All utilities and site features shown to be removed on demolition plan shall not be shown on Utility Plan.

- (6) Landscape Plan: Concept landscape plan showing proposed plantings and hardscaping. The drawings shall be prepared in scale with the site layout and grading plans, and shall include reference coordinates, north arrows, graphic scales and appropriate legends. An overall planting layout shall be developed and enlarged detail plans of specific areas shall be provided as needed to clarify requirements. The proposed layout shall indicate shade trees, evergreen trees, flowering trees, shrub masses, etc. according to designated functional and visual criteria. A legend including sizes of plants recommended for each of the above categories shall be provided. The drawings and all subsequent plans shall indicate existing and proposed buildings, paved areas,

signs, lights, transformers, dumpster areas, storm drainage system, and other structures and utilities.

- c. Outline Specifications: Appropriate guide specifications should be selected and listed for the civil and environmental aspects of the project.
- d. Anticipated permit requirements for water and wastewater features shall be described.

#### 3.2.2.3 Structural

The 35% structural design submittal shall outline proposed methods and materials of design and construction for approval. Include the following:

##### a. Design Analysis:

- (1) Narrative that describes the gravity and lateral load system to be used. The design analysis shall include references, government design documents, and industry standards.
- (2) Load Assumption: State live loads to be designed for and include roof and floor loads. Calculate the wind loads and lateral earth pressure loads.
  - (a) Calculate both positive and negative wind pressure with controlling pressures summarized in tabular form. Include following wind pressures as minimum: wind on frame, wall, wall corners, roof, roof ridges, eaves, and roof corners.
  - (b) Calculate basic seismic loading for frame or lateral load resisting system and contrast with comparable wind loads.
- (3) Material Properties: Describe anticipated yield and design strength values to be used in structural materials.
- (4) Structural Calculations: Furnish calculations for wind, snow, seismic, ATFP loads.

##### b. Drawings:

- (1) General sheet notes that list all loads, codes, references, geotechnical report, material properties, design live loads, design wind speed, seismic site classification values
- (2) Framing plan with grid lines and dimensions
- (3) Foundation plan with grid lines and dimensions

##### c. Specifications

List of applicable guide specifications.

#### 3.2.2.4 Architectural

- a. Design Analysis: A preliminary description of interior and exterior design concepts and the rationale behind major design decisions must be provided. A building code and life safety analysis must be included. Include space allowance, functional layout, unique features,

interior design, furniture planning, signage, accessibility, security, air barrier strategy, energy conservation and sustainable design approach to include site analysis focusing on orientation, space-mass composition, materials used and details with respect to image, safety, maintenance and cost effectiveness and historical context. All references used in the design must be listed, including Government design documents and industry standards.

b. Drawings:

- (1) Life Safety Analysis Plans: Life Safety Analysis Plan sheets shall be referenced as architectural sheets (ex. A-001) and placed before the other architectural drawing sheets. Include the following data and provide a legend for symbols used on the drawings: type of occupancy, type of construction, fire/smoke compartments, exit width calculations and number of exits, location and rating of walls (1 hr., 2 hr., etc.), door labels, door hold open devices, fire extinguisher and/or fire hose cabinet locations, egress, dead-end, and common path of travel distances indicating code compliance, smoke proof doors, and exit lights.
- (2) Floor Plans: Provide a floor plan or floor plan segments, 1/8-inch scale minimum, for each floor showing functional elements, drawn to scale. Show planning grid and/or column lines, overall and building element location dimensions, room names and numbers, finish floor elevations for each floor or change in floor level, opening designations in walls (doors, windows, etc.), all major equipment, furnishings layouts for typical rooms where required, gross floor area tabulations, cross-references for sections and details, and provisions to meet the Architectural Barriers Act (ABA).
- (3) Demolition Plans: Floor plans showing demolition work in sufficient detail to indicate all existing building materials and finish conditions are required for renovation and modification projects. Drawings shall be of sufficient detail to indicate "existing to remain," "existing to be removed," and new work and materials. The drawings shall be complete with adequate detail and descriptions of existing materials, assemblies, and systems (type, thickness, quantity spacing, length, width, height, etc.).
- (4) Building Elevations: Provide building elevations showing the exterior design of all major elevations. Each elevation shall show planning grid and/or column lines, building masses, door and window opening designations, and penetrations by other disciplines, identification of major building materials, roof mounted equipment and roof accessories when visible in elevations, and elevation and vertical dimensions of floor lines.
- (5) Building Sections: Provide building sections as necessary to demonstrate the coordination of the structural, mechanical, and electrical systems. Provide at least one (1) longitudinal and one (1) transverse section through the entire building. Sections shall show planning grid and/or column lines, structural system, changes in floor levels, finish ceilings, floor-to-ceiling and floor-to-floor heights, floor elevations, spaces to be used by the lighting and HVAC systems, and adjacent grades.
- (6) Typical Wall Sections: Provide typical annotated wall sections.

These sections shall show structural system, exterior wall and roof assemblies, ceiling systems, floor-to-ceiling and floor-to-floor heights, floor elevations, spaces to be used by the lighting and HVAC systems, and "U" values through roof, walls, and floors.

(7) Schedules: Provide sheets to indicate all schedule sheets that will be provided. At a minimum provide schematic door, window, partition with fire and acoustical ratings, finish, and equipment schedules. Schematic door schedules must indicate sizes, ratings, and types.

(8) Details: In addition to the above requirements, show details of any significant design features and any sections necessary to demonstrate the required coordination of the various building systems.

c. Specifications: Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

### 3.2.2.5 Fire Protection System

#### a. Design Analysis:

- (1) All references used in the design including Government design documents and industry standards shall be listed.
- (2) Each building shall be classified in accordance with fire zone, building floor areas, and height and number of stories.
- (3) A description of required fire protection including extinguishing equipment, detection equipment, alarm equipment and water supply shall be provided. Alarm and detection equipment shall interface to requirements of Electronic Systems.
- (4) Hydraulic calculations based on water flow test shall be prepared for each sprinkler system to ensure that flow and pressure requirements can be met with current water supply. This analysis must include an estimate for the minimum required capacity of water, along with minimum volumetric water flow rate and water pressure, with all assumptions clearly defined and referenced and must demonstrate that the available water supply is capable of meeting the required water demands in any project. Include a graphical analysis of the relationship between the Fire Water Demand and the available water supply.
- (5) Use the information outlined in the document associated with this section at to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".

#### b. Drawings:

- (1) A plan shall be prepared for each floor of the building that presents a compendium of the total fire protection features being incorporated into the design. Provide fire alarm drawings in accordance with NFPA 72 for the building. Provide fire

suppression drawings in accordance with NFPA 13 for the building.

- (2) Provide a fire alarm cover sheet with notes, legend and applicable code criteria.
- (3) Provide preliminary fire alarm initiating and fire alarm indicating devices for each floor.
- (4) Provide preliminary placement of mass notification devices for each floor.
- (5) Provide detail sheet as required.
- (6) Provide a fire suppression cover sheet with notes, legend and applicable code criteria.
- (7) Provide as a minimum, the automatic sprinkler design densities (cross-hatched or otherwise) for each area of the buildings.
- (8) Provide a demolition plan (as required). Items to be removed, abandoned and relocated shall be clearly indicated with a legend.
- (9) Any hazardous areas and their classification.
- (10) The location of any other major fire protection equipment.
- (11) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc.
- (12) A schedule describing the system with the following information: fire hazard and occupancy classifications, building construction type, GPM/ square foot sprinkler density, area of operation and other criteria as required.

c. Specifications:

Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

3.2.2.6 Plumbing

a. Design Analysis:

- (1) All references used in the design including Government design documents and industry standards.
- (2) Justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use shall be provided.
- (3) A description of the system(s) to be used along with a list of standards (including date and reference to applicable sections or paragraphs) upon which the design is based will be submitted.
- (4) Detailed calculations for systems such as sizing of waste and water piping; water heaters and pumps.
- (5) Calculations necessary to determine equipment capacities and their

corresponding utility requirements will be provided.

- (6) Calculations related to water conservation features such as gray water systems and solar preheat systems will be included.

b. Drawings:

- (1) Preliminary drawings to include plumbing fixture layout, floor and area drains, and single-line piping and equipment layout.
- (2) Preliminary equipment and fixture schedules with descriptions, capacities, locations, connection sizes and other information as required.
- (3) Demolition Plan (as required) to include items to be removed, abandoned and relocated shall be clearly indicated with a legend.

c. Specifications:

Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

3.2.2.7 Heating, Ventilating, and Air Conditioning (HVAC)

a. Design Analysis:

- (1) All references used in the design, including Government design documents and industry standards, shall be listed.
- (2) Provide a description of the intended HVAC system type and any mechanical systems not dedicated to HVAC.
- (3) Provide preliminary load calculations for the major mechanical systems.
- (4) Provide equipment cutsheets for preliminary equipment selections.

b. Drawings:

- (1) Provided a mechanical legend sheet with a legend, abbreviations and general notes.
- (2) Provide floorplans for each floor showing preliminary ductwork and piping mains. Separate drawings for ductwork, HVAC piping and plumbing piping shall be provided.
- (3) Show mechanical room enlargements demonstrating sufficient space for equipment including maintenance clearances.
- (4) Provide mechanical utility plan (if required) showing all mechanical distribution outside the 5 ft line.
- (5) Provide preliminary equipment schedules for major mechanical equipment.
- (6) Provide a demolition plan (as required). Items to be removed, abandoned and relocated shall be clearly indicated with a legend.

c. Specifications:

Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

### 3.2.2.8 Interior Electrical System

- a. Design Analysis: Include all references used in the design, including Government design documents and industry standards, shall be listed.
  - (1) A narrative, indicate electrical characteristics (phase, voltage, and number of wires) for the electrical system shall be provided, including a justification for the system chosen. The narratives should include a scope of work for the electrical, security, and telecommunications work. A preliminary load letter should be provided to the utility company. A lightning protection risk analysis should be included.
  - (2) A description of the lighting system(s) to be used for all areas shall be provided, including referencing calculations.
  - (3) A tabulation showing the following shall be provided:
    - (a) Room name and number.
    - (b) Lighting intensity for each room. (State the basis for selection such as I.E.S., etc.).
    - (c) The type of fixture (identified by manufacturers catalog cuts).
    - (d) The type of wiring system to be used, such as insulated conductors installed in rigid or intermediate metal conduit, insulated conductors installed in electrical metallic tubing, nonmetallic sheathed cables, etc.
    - (e) A paragraph describing any special design items such as handicapped and seismic design requirements, power filters, emergency power system, UPS, etc.
    - (f) Any hazardous classified locations by class, division, and group as defined by the National Electrical Code. The types of equipment to be used in these areas. State the reasons for the area(s) being hazardous classified locations shall be indicated.
    - (g) Lightning protection system to be installed, including the type of grounding system.
    - (h) The basic characteristics of panel-boards, switchgear, switchboards, motor control centers, transfer switches, UPS, and other major pieces of electrical equipment being provided. Short circuit and voltage drop calculations showing these values at all equipment with protective devices included shall be provided. Equipment interrupting ratings and short circuit withstand ratings based on these calculations shall be indicated.
    - (i) The electrical metering equipment to be provided.
  - (4) A statement that no duct or liquid piping shall pass over and/or through any electrical space and/or room as defined by the NFPA 70 Article 384 shall be provided.



- b. Drawings: Panelboards, switchboards, switchgear, motor control centers, and all other utilization equipment shall be located on the floor plans.
  - (1) Details of the layouts for electrical closets and rooms shall be shown.
  - (2) Receptacles and lighting layouts, including complete wiring, shall be shown for typical rooms. Typical rooms are those which appear more than one time or rooms of different sizes but the same function.
  - (3) Areas where nonlinear loads will be encountered shall be identified.
- c. Outline Specifications: Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

#### 3.2.2.9 Exterior Electrical Distribution System

- a. The Contractor shall provide site telecommunications plans which show where copper and fiber cabling shall be pulled from, and how it will be routed into the telecommunications room. Routing should show manholes and/or handholes used in this pathway
- b. Outline Specifications: Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

#### 3.2.2.10 Electronic Systems

- a. Design Analysis: All references used in the design including Government design documents and industry standards shall be listed.

A narrative shall be provided describing all electronic systems in the project, including systems for fire detection and suppression control, public address, telephone, television, special grounding, cathodic protection, intrusion detection, card access, and central security control and monitoring.

- b. Drawings: Floorplan layout of electronic security devices should be included.
- c. Outline Specifications: Outline specifications based on the appropriate guide specifications must be provided for all aspects of the project.

#### 3.2.3 Preliminary (65%) Design Submittal

The review of this submittal is primarily to ensure that the contract documents and design analysis are proceeding in a timely manner and that the design criteria are being correctly interpreted. The design submittal must contain, as a minimum, the following:

##### 3.2.3.1 Geotechnical

The geotechnical report must be a complete stand alone document and must

be stamped and signed by a registered professional engineer (P.E.), specializing in geotechnical engineering consultation and having experience in the project's geographical region. The report must address all of the geotechnical requirements listed in the RFP documents and must include those listed herein. NOTE: The Preliminary Geotechnical Report included with the RFP documents provides information which may be relied upon for completing the requirements stated herein.

- a. Project Location
- b. Project Description: The type of structures (number of stories, type of construction (steel, concrete, masonry), basement, slab-on-grade, pavement types, etc.
- c. Site Description: Topography, grassed, paved, existing structures etc.
- d. Site Investigation:
  - (1) Subsurface investigation: The number and depth of drill holes, test pits, CPTs etc. The type of drilling method used (SPT, auger, wash boring, rock coring etc.). A subsurface exploration plan should be included as an appendix showing the location of all borings, test pits, CPTs etc. Final boring logs must be included as an appendix to the report and they must also be shown on the contract drawings. Include soils profiles if available.
  - (2) Laboratory Testing: The number and type of tests performed. Test results must be provided as an appendix to the report.
- e. Subsurface Conditions:
  - (1) Regional Geology: A description of the regional geology at the project site.
  - (2) Soil Stratigraphy: A discussion of the different soil types and layers encountered, consistency and Standard Penetration Test (SPT) blow counts specific to the project site.
  - (3) Bedrock Stratigraphy: A discussion of the different rock layers, types, quality, RQD, etc.
  - (4) Groundwater: Discuss groundwater depths encountered and discuss any impacts it will have during construction.
- f. Foundation Design: Include applicable references used and assumptions made in the foundation analysis. Include design structural loads and allowable settlements. Provide allowable soil/rock bearing capacity, minimum and maximum footing sizes or type and sizes of deep foundation elements and magnitude of anticipated settlements. Calculations to support the foundation recommendations must be included as an appendix.
- g. Pavement Design: Include applicable references used and assumptions made. Provide information of the type of traffic (type and frequency of vehicle passes) anticipated on the pavements and the subgrade type and strength used in the analysis. Provide recommended final pavement sections and indicate what design method (strength, Frost reduced subgrade strength, Frost limited subgrade frost penetration method) it was based on. Discuss pavement subdrainage.

- h. Earthwork: Discuss what soils are considered satisfactory and unsatisfactory for fill and backfill for paved areas and overlot areas. Indicate the compaction and moisture control requirements and by test methods it will be compared to (standard proctor, Modified Proctor). Indicate if subgrade/soil stabilization will be required. If stabilization is required, discuss the method of stabilization.
- i. Include a discussion with supporting documentation on any other related geotechnical matter that is necessary as a part of this contract.
- j. Details: Include any foundation and pavement details that would enhance or clarify the design recommendations.

### 3.2.3.2 Site Development

In addition to the items listed in the previous Concept (35%) submittal requirements, the following shall be included:

- a. Design Analysis: Provide additional narrative reflecting 65% level design. Provide civil design calculations in a Civil Appendix, including but not limited to:
  - (1) Utility Design: Provide design calculations for storm drain, water, and sanitary sewer.
  - (2) Stormwater Management: Provide stormwater design calculations to comply with regulatory requirements.
  - (3) Erosion and Sediment Control: Provide design calculations for erosion and sediment control features, if applicable.
- b. Drawings:
  - (1) Erosion and Sedimentation Control Plan and Details: Temporary erosion and sediment control measures for the construction activity must be shown. Include a sequence of construction and E&S notes and details.
  - (2) Profiles: Profile new roads and utilities. All profiles should be drawn on compatible scales. The vertical scale may vary where profiles transverse very steep topography.

#### Utility Profiles:

- (a) Existing and Finish Grade
- (b) 10-Year HGL for storm drain profiles
- (c) Manholes, inlets, headwalls, etc., with numeric designations (corresponding to those shown on utility plan).
- (d) Top and invert elevations.
- (e) Size, length, slopes, and material of all lines.
- (f) All existing and new utility crossings labeled with utility type, size, and material, if known.

(g) Type of structures (i.e., Type "E" inlet, Std. MH, etc.) required at each junction

(h) Horizontal and Vertical Bends Road and Site Profiles: Existing and finished grade with all vertical alignment geometric data shown.

(3) Details: Standard details for site features, storm drainage, water, sanitary sewer, erosion and sediment control, stormwater management, and landscaping shall be provided in compliance with owner or regulatory criteria, such as Installation Design Guides or, if none are available, the respective State highway and drainage standard details. Special details must be prepared as required for special site features, such as fencing or benches. The Contracting Officer may request a detail to be provided on the design drawings.

c. Redlined Specifications: Provide all applicable civil and landscape specifications showing edits.

### 3.2.3.3 Structural

Include all items in 35% submission and any revisions necessitated by comments on the 35% submittal. Include the following:

#### a. Design Analysis:

- (1) Shall be substantially complete for all major structural features for primary structure.
- (2) Provide a narrative that provides reference, design loads, and brief description of the structure to include foundation, type of framing, and method of resisting lateral load.
- (3) Special Criteria, include synopsis of special design criteria or technical requirements.

#### b. Drawings:

- (1) Plans shall contain gridlines or center lines for buildings framed with columns and beams. Load bearing wall systems shall have grid lines that go to outside face of studs or masonry.
- (2) General sheet notes that list all loads, codes, references, and geotechnical report including allowable soil bearing value.
- (3) Plans
  - (a) Roof plan for building.
  - (b) Framing plan for each floor including all principal members.
  - (c) Foundation plan showing main footings and grade beams as applicable.
  - (d) Typical bay if repetitive bays are used.
  - (e) Layout of floor joints, construction, expansion, seismic joints in foundation, floor, and building framing.

(f) Beam, column, footing schedules as used.

(4) Sections:

(a) Typical section through foundation, floor, roof framing for building.

(b) Additional sections and details illustrating special items/conditions for which approval is sought.

c. Calculations:

(1) Computer analyses, hand calculation shall be furnished for all principal roof, floor, and foundation members. The computer software shall be widely accepted and commercially available. Sufficient documentation shall be provided to interpret input and output.

(2) Complete calculation of seismic, wind loads, and blast design as needed distributed to lateral load resisting element.

(3) Roof, floor decks, beam, joist, girders, columns as applicable.

(4) Horizontal diaphragm and bracing to include shear transfer connection.

(5) Exterior cladding (masonry, steel, precast concrete for flexure, shear, overturning if applicable).

(6) Shearwalls and bracing.

(7) Progressive collapse calculations in accordance with UFC 4-023-03 as applicable.

(8) AITP calculations in accordance with UFC 4-010-01 as applicable.

d. Specifications:

List of applicable guide specifications with red mark changes visible.

3.2.3.4 Architectural

a. Design Analysis: A working description of interior and exterior design concepts and the rationale behind major design decisions must be provided. A building code and life safety analysis must be included. Include space allowance, functional layout, unique features, interior design, furniture planning, signage, accessibility, security, air barrier strategy, energy conservation and sustainable design approach to include site analysis focusing on orientation, space-mass composition, materials used and details with respect to image, safety, maintenance and cost effectiveness and historical context. All references used in the design must be listed, including Government design documents and industry standards.

b. Drawings: Include the air barrier path in wall sections and details and indicate air barrier materials. Toilet rooms and other specialized areas must be drawn to 1/4" scale. Include interior elevations of toilet rooms showing fixtures and of other walls

locating wall-mounted equipment. Design features such as fascias, soffits, lighting troughs, etc., must be indicated with interior elevations or other details. Provide a schematic furniture layout showing room sizes are able to accommodate all required furniture, fixtures, and equipment (FF&E). Any special graphics or informational displays to be provided must be listed. Provide a three-dimensional view showing massing, fenestration and materials in color. Plans must indicate space/room names and numbers, dimensions, column lines, and view sheet references. Drawings must include North arrows, graphic scales, and appropriate legends. Ensure that all drawings have been updated to address applicable review comments from the previous submission. Update all plans from the previous submission as follows:

- (1) Life Safety Analysis Plans: Update as needed to reflect any changes from the previous submission.
- (2) Floor Plans: Provide plans for each floor, roof, and ceiling showing dimensions, functional arrangement, and equipment for all areas, including corridors, exits, stairs, and utility spaces. The relationship of the building to exterior access, vehicle parking, service areas, etc., shall be indicated on site plans. Individual treatment shall be given to special design or items involving deviation from normally accepted standards. All column lines shall be designated to aid in locating project components. Identify fire walls, smoke partitions, and all fire rated construction. Show indications of phased construction if required. Thoroughly cross-reference section cut symbols on plans and elevations to detail sheets. Complete door and window details to minimum of 65%. Identify all interior wall and partition types on floor plans and reference them to the partition schedule showing construction, heights, fire ratings, and acoustical ratings. Provide Air barrier plans showing that all sides of the building are covered by an air barrier. Include a description of the air barrier types and how transitions between differing construction types or materials are covered to prevent any gaps in the system.
- (3) Demolition Plans: Floor plans showing demolition work in sufficient detail to indicate all existing building materials and finish conditions are required for renovation and modification projects. Drawings shall be of sufficient detail to indicate "existing to remain," "existing to be removed," and new work and materials. The drawings shall be complete with adequate detail and descriptions of existing materials, assemblies, and systems (type, thickness, quantity spacing, length, width, height, etc.).
- (4) Building Elevations: Provide building elevations showing the exterior design of all major elevations. Each elevation shall show planning grid and/or column lines, building masses, door and window opening designations, and penetrations by other disciplines, identification of major building materials, roof mounted equipment and roof accessories when visible in elevations, and elevation and vertical dimensions of floor lines.
- (5) Building Sections: Provide building sections as necessary to demonstrate the coordination of the structural, mechanical, and electrical systems. Provide at least one (1) longitudinal and one (1) transverse section through the entire building. Sections shall show planning grid and/or column lines, structural system, changes

in floor levels, finish ceilings, floor-to-ceiling and floor-to-floor heights, floor elevations, spaces to be used by the lighting and HVAC systems, and adjacent grades.

- (6) Wall Sections: Provide wall sections for every condition where there are changes of construction or material types. These sections shall show any barriers such as air and moisture, insulation, drainage, structural system, exterior wall and roof assemblies, ceiling systems, floor-to-ceiling and floor-to-floor heights, floor elevations, spaces to be used by the lighting and HVAC systems, and "U" values through roof, walls, and floors.
- (7) Schedules: Update the schedules from the previous submission. In addition provide a signage schedule. Schedules need not be complete at this point, however, they shall be developed in sufficient detail to indicate the door and window sizes and major equipment items.
- (8) Details: Continue development of all details to ensure coverage of all significant design features and any details necessary to demonstrate the required coordination of the various building systems.

- c. Specifications: Provide redlined marked-up specifications covering all aspects of the project.

#### 3.2.3.5 Fire Protection System

Include all items in 35% submission and any revisions necessitated by comments on the 35% submittal. In addition include the following:

- a. Design Analysis:

Update the 35% design analysis as required. Revise the design analysis to coincide with changes promulgated by other disciplines (architectural, mechanical, etc.).

- b. Drawings:

- (1) Provide fire alarm riser diagram and control matrix.
- (2) Provide fire suppression riser diagram.
- (3) Provide details as required.

- c. Specifications:

Provide "red-lined" edited fire alarm and fire suppression specifications.

#### 3.2.3.6 Plumbing

Include all items in 35% submission and any revisions necessitated by comments on the 35% submittal. Include the following:

- a. Design Analysis:

- (1) Final pipe sizing calculations.

## Repair Steam Sterilization Plant (SSP)

- (2) Final calculations for compressed air, natural gas, and other plumbing systems (as required).
- (3) Provide catalog cuts sufficient in detail to demonstrate compliance with all contract requirements, including the contract specifications from at least one vendor, will be included for all major items of equipment.

### b. Drawings:

- (1) Plans and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Piping layouts and risers should also include natural gas, and radon piping must be provided as required.
- (2) Final equipment and fixture schedules with descriptions, capacities, locations, connection sizes and other information as required.
- (3) Drawings shall be coordinated with the mechanical systems such as providing floor drains for air handling units.

### c. Specifications:

Provide "red-lined" edited fire alarm and fire suppression specifications.

## 3.2.3.7 Heating, Ventilating, and Air Conditioning (HVAC)

Include all items in 35% submission and any revisions necessitated by comments on the 35% submittal. In addition include the following:

### a. Design Analysis:

- (1) Update the 35% design analysis as required.
- (2) Finalize load calculations for all equipment in the building.
- (3) Provide preliminary energy comparison of the proposed system to the ASHRAE 90.1 - IP Baseline.
- (4) Provide all pressure drop calculations for ductwork and piping.
- (5) Provide expansion loop calculations.

### b. Drawings:

- (1) Update 35% drawings as required.
- (2) Provide preliminary sections at key points in the building showing coordination with other disciplines.
- (3) Provide preliminary controls drawings consisting of legend, controls architecture drawing, controls schematics by system, sequence of operations, and points schedules.
- (4) Provide preliminary detail sheets.
- (5) Ductwork and piping plans shall be updated to show branches and



sizing.

c. Specifications:

Provide "red-lined" edited fire alarm and fire suppression specifications.

3.2.3.8 Interior Electrical System

In addition to the items listed in the previous submittal, the following items are required:

- a. Design Analysis: The design analysis narrative should be updated to include an updated load letter to the utility company, voltage drop calculations, short circuit analysis, lighting calculations including average footcandle levels in addition to point-by-point footcandle display, cable tray fill calculations. Cutsheets should be provided for the basis of design equipment used.
- b. Drawings: The power riser or one-line diagram must be essentially complete except for finalization of conduit and wire sizes.
  - 1. Schedules for panelboards, switchboards, switchgear, motor control centers, and all other utilization equipment must be provided, and must include all pertinent information to fully describe the equipment. Elevations for free standing equipment must be provided.
  - 2. A completed fixture schedule as well as lighting sequence of operation must be included on the drawings.
- c. Specifications: Marked up edited specifications based on the appropriate guide specifications must be provided for all aspects of the project.

3.2.3.9 Exterior Electrical Distribution System

- a. The Contractor shall update the site telecom plans and provide ductbank and manhole/handhole details.
- b. Specifications: Marked up edited specifications based on the appropriate guide specifications must be provided for all aspects of the project.
- c. Contractor shall be responsible to coordinate all power shutdowns with contracting officer as required for new work.

3.2.3.10 Electronic Systems

In addition to the items listed in the previous submittal, the following items are required:

- a. Design Analysis: The design analysis must include all calculations required to support design decisions and estimates. The analysis must include specific criteria furnished, conference minutes and cost analyses of all systems considered.
- b. Drawings: Design of the fire alarm and detection system must include a riser diagram showing the control panel, annunciator panel, zones,

radio transmitter and interfaces with other systems (HVAC, sprinkler, foam, hood dry chemical, etc.).

- (1) All components of the Fire Suppression (FS) System must be specified in the specifications. The system operation and interaction with other systems, such as the fire alarm system, will be clearly described. A riser diagram must be included in the drawings to show principal components and interconnections with other systems. FS system components must be indicated on drawing legends. All components shown on floor plans must be designated as FS system components (as opposed to Fire Alarm components). The location of FS control panels, HVAC control devices, sensors, and 120V power panel connections must be shown on the floor plans. The numbers and sizes of conductors and conduits for detector circuits must not be shown since this varies among suppliers. Zoning of areas must be indicated by numbers (1, 2, 3), and detectors subzoned for cross zoning must be indicated by letter designations (A and B). Ceiling mounted detectors must be differentiated from underfloor detectors by distinct symbols indicating the subzone of each.
  - (2) Telephone conduit system riser diagrams, including conduit sizes, must be shown. Conduit runs between backboard and outlets must not be shown on the floor plans. Underground telephone distribution conduit must be shown on either the electrical or electronic site plan.
  - (3) The grounding system specifications and drawings must clearly reflect all design requirements. The specifications must require field tests during the construction phase, and to be witnessed by the Contracting Officer, for determining the effectiveness of the grounding system. Drawings showing existing construction must be provided. The Contractor must verification of the validity of any existing drawings and/or any other data furnished by the Government.
  - (4) The name of the licensed corrosion engineer or NACE specialist to be utilized for the design must be provided. The following must be provided for cathodic protection systems:
    - (a) Define areas of structures or components in soil or water to be protected.
    - (b) Comparison of systems and equipment, including cost estimates for all alternatives, and the type of system recommended.
    - (c) Calculations for all systems considered, including related information and descriptions.
    - (d) Cathodic protection design, including comprehensive specifications and drawings meeting the protection criteria. The design plans and specifications must show the extent of the facilities to be protected, location and type of anodes, location of test points, and details for sectionalizing an underground piping system. The design must be sufficient for purchasing equipment and building the system without design changes.
- c. Specifications: Marked up edited specifications based on the appropriate guide specifications must be provided for all aspects of

the project.

#### 3.2.4 Final (100%) Design Submittal

The review of this submittal is to ensure that the design is in accordance with directions to the Contractor provided during the design process. The Final Design Submittals must contain, as a minimum, the following items:

- a. Complete construction documents plans and specifications at the level of detail needed for bidding the project, including a complete list of equipment, fixtures, and materials to be used. The final drawings are an extension of the previously reviewed drawings and must include those comments. All details must be shown on the drawings.
- b. Complete design analysis verifying that the design complies with the requirements of the project. The final design analysis is an extension of the previously reviewed design analysis and must include those comments.
- c. Marked-up specifications. The specifications must be coordinated with the drawings, and must describe in detail all items shown on the drawings.

##### 3.2.4.1 Geotechnical

A final geotechnical report and design analysis must be provided. The report must be complete including any information not provided in the previous design submittal.

##### 3.2.4.2 Site Development

In addition to the items listed in the previous Concept (35%) and Preliminary (65%) submittal requirements, the following shall be included:

- a. Design Analysis: The final design analysis should address all site development aspects and in particular the following:
  - (1) Storm Drainage: Storm drainage system must be fully described and the basis for design, including all criteria used, must be provided. Layout sketches of storm drainage areas showing inlets and piping must be included. Calculations for capacities of the various inlets selected for the project must be provided. Storm drainage calculations indicating flow and velocity computations are provided. Roof drain computations are included. A sketch of the roof areas must be provided showing drainage areas, locations and sizes of gutters, downspouts, and the roof drainage collector system. The interior roof drainage system, if applicable, shall be coordinated with all other design disciplines to avoid conflicts with mechanical piping and ductwork, structural components, etc.
  - (2) Water Service and Fire Protection: Proposed work is described in accordance with utility owner. References must be cited, and calculations are shown. A sketch of water systems in the vicinity of the project must be provided. Existing water storage facilities and capacities on Post must be noted, and results of hydrant flow tests must be provided.
  - (3) Sanitary Sewer: Proposed work is described in accordance with utility owner. References must be cited, and calculations are

shown. A sketch of sewer systems in the vicinity of the project must be provided.

- b. Drawings: The final drawings are a continuation of the ones prepared for the concept and preliminary submissions, and shall address all site development aspects and in particular the following:

- (1) Survey Plan.
- (2) Demolition Plan: All items to be removed, abandoned, capped, plugged and relocated utilities must be included.
- (3) Layout Plan: Existing and new buildings, roads, streets, walks, parking and service areas, etc. must be shown. New or existing contours and spot elevations must not be shown. The baseline survey coordinate information from which all new facilities are to be located must be clearly indicated. The layout must be complete and fully dimensioned. Stationing and curve data must be provided for fire lane layout if applicable. A complete legend must be provided.
- (4) Grading and Drainage Plan: New and existing contours and spot elevations must be shown in such detail that there will be no question regarding grading to provide positive drainage away from the existing building and indicated stormwater management facilities. Inlets are shown with top of frame elevations indicated, manholes, valves, hydrants, headwalls and all existing underground utilities. Any other features of work which will appear on the new ground surface must be shown. New utility lines are not shown, except storm drainage.
- (5) Utility Plan: Each existing and new utility must be clearly shown, including building service connections and connections to existing lines. Locations of all new and existing fire hydrants, valves, manholes, inlets, etc. must be indicated. Sizes of existing and new lines must be shown, including new inlet and manhole numbers. A complete legend must be provided. All new piping, inlets, manholes, hydrants, etc., must be located survey coordinates. All roof drain piping to storm drains must be shown. All storm drain piping for stormwater management must be indicated. Subdrain piping for paved areas must be shown, if required.
- (6) Concrete Joint Plan (if applicable): Provide a joint layout plan for each concrete apron, hardstands, road, pavement, etc.
- (7) Final Profiles.
- (8) Final Details.
- (9) Landscape: Final design drawing(s) must include a complete schedule of plant materials indicating botanical and common names, plan symbols, quantities, sizes, condition furnished, and pertinent remarks. Drawings must correspond with the site layout and grading plans, and must include reference coordinates, north arrows, graphic scales and appropriate legends. An overall planting layout must be developed including enlarged detail plans of specific areas as needed to clarify requirements. Final design drawings must indicate proposed plants by a (+) mark for the plant

location and a circle scaled to approximately 2/3 the ultimate growth spread (diameter) of plants. Final drawings must also include the basic details for installation of tree, shrub, and ground cover planting, as well as any other applicable details for clarification of specific project requirements.

c. Erosion and Sedimentation Control, Storm Water Management, and National Pollutant Discharge Elimination System (NPDES) Permit:

- (1) Erosion and Sedimentation Control Plans and Stormwater Management Plans must be prepared and permits obtained by the Designer of Record during design.
- (2) Final erosion and sediment control and stormwater management design calculations and narrative shall be provided.

d. Permits for Water Supply and Sanitary Sewage:

The Designer of Record must contact utility owners to verify the correct procedure to follow to obtain construction permits. The Designer of Record must prepare and submit the final design package all permit applications.

e. Specifications: Provide final edited civil and landscape specifications.

### 3.2.4.3 Structural

Include all items in 65% submission and any revisions necessitated by comments on the 65% submittal. Include the following:

a. Design Analysis:

Professional engineer specializing in structural engineer stamped and signed calculations for all structural members. Individual calculation sheets shall bear initials of peer reviewer. Incorporate changes from 65% submittal.

b. Drawings

Complete final plans and details of all structural elements coordinated with other design disciplines. It shall also include general sheet notes. Include items listed below as applicable:

- (1) Roof framing plans and details including openings in roof.
- (2) Intermediate floor framing plans and stair details.
- (3) Stress or load diagrams of features to be construction contractor designed.
- (4) Column schedule, beam schedule, connection schedule.
- (5) Foundation plans with notes.
- (6) Foundation sections and details.
- (7) Layout of floor joints, construction, expansion, seismic joints in foundation, floor, and building framing.

(8) Typical sections and special sections as required.

(9) Details of special items, i.e., seismic details, supporting structural elements for ATPF.

c. Specifications

Submit complete set of final specifications and revised for the project for review

3.2.4.4 Architectural

a. Design Analysis: A complete description of interior and exterior design concepts and the rationale behind major design decisions must be provided. A complete building code and life safety analysis must be included. Include space allowance, functional layout, unique features, interior design, furniture planning, signage, accessibility, security, air barrier strategy, energy conservation and sustainable design approach to include site analysis focusing on orientation, space-mass composition, materials used and details with respect to image, safety, maintenance and cost effectiveness and historical context. All references used in the design must be listed, including Government design documents and industry standards.

b. Drawings: All drawings must be thoroughly checked and coordinated with the specifications and with other design disciplines. Drawings from the previous submission (as described in the Preliminary Design Submittal section of this document) must be completed with all additional drawings included as necessary for a complete package. The plans must be in compliance with applicable codes and regulations. Comments generated from previous design review submittals must be incorporated, and the consistency between plans and specification must be verified. The evaluation of the Contractor's submittals must be based on the degree to which the submittal meets the requirements set forth in this document and the specifications. Completed working drawings must include plans, elevations, sections, details, schedules, and all other drawings necessary to communicate design intent, and to identify, quantify, and describe project materials and their assembly. Provide a three-dimensional view showing massing, fenestration and materials articulated to meet the needs of the customer.

c. Specifications: Specification sets must be complete with all edits incorporated and coordinated.

3.2.4.5 Effluent Decontamination System (EDS) Equipment

a. Drawings:

(1) Include equipment connection schedules with descriptions, capacities, locations, connection sizes and other information as required.

(2) Plan and isometric riser diagrams or all areas including hot water, cold water, waste, steam and vent piping.

(3) Show locations and arrangement of major equipment, showing all locations of utility connections to the EDS equipment.

- (4) All devices requiring monitoring by the BAS are reflected in the mechanical controls drawings.

b. Specifications:

Submit complete set of final specifications and revised for the project for review.

3.2.4.6 Fire Protection System

Include all items in 65% submission and any revisions necessitated by comments on the 65% submittal.

a. Design Analysis:

- (1) Include building code analysis and basis of design for sprinkler and other suppression systems.
- (2) An FPE must perform all fire protection analyses. Provide the fire protection engineer's qualifications.
- (3) List all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.
- (4) Classification of each building in accordance with fire zone, building floor areas and height and number of stories.
- (5) Discussion and description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Interface alarm and detection equipment to requirements of Electronic Systems.
- (6) Provide hydraulic calculations based on water flow test for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of water flow testing done to certify the available water source.
- (7) A file of the input data used in the computer program to design the fire suppression system.

b. Drawings:

- (1) Plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design.
- (2) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, and exit passageways.
- (3) The location and coverage of any fire detection systems.
- (4) The location and coverage of any fire suppression systems (e.g., sprinkler risers, standpipes).
- (5) The location of any other major fire protection equipment.

- (6) Indicate any hazardous areas and their classification.
- (7) Schedule describing the internal systems with the following information: fire hazard and occupancy classifications; building construction type; GPM/square foot sprinkler density; area of operation and other as required.
- (8) Meet NFPA 13 requirements with respect to required minimum level of detail on working plans and all other submitted materials.

c. Specifications:

Submit complete set of final specifications and revised for the project for review.

3.2.4.7 Plumbing Design

Include all items in 65% submission and any revisions necessitated by comments on the 65% submittal.

a. Design Analysis:

- (1) List all references used in the design including Government design documents and industry standards.
- (2) Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.
- (3) Detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping; LP gas piping and tanks; fuel oil piping and tanks.
- (4) All pipe sizing calculations shall be completed and submitted. For all pipes, the calculations will include design flow (in gpm and fixture units), pipe size, velocity, friction factors, slopes, lengths and the pressure and flow available at each fixture at designed conditions.
- (5) Water heating system demand and storage calculations will be provided.

b. Drawings:

- (1) Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required.
- (2) Plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Include natural gas (and meter as required), LP gas, fuel oil and other specialty systems as applicable.
- (3) Show locations and arrangement of plumbing fixtures and major equipment.
- (4) All devices requiring monitoring by the BAS are reflected in the mechanical controls drawings.

c. Specifications:



Submit complete set of final specifications and revised for the project for review.

#### 3.2.4.8 Heating, Ventilating and Air Conditioning (HVAC)

Include all items in 65% submission and any revisions necessitated by comments on the 65% submittal.

##### a. Design Analysis:

- (1) Provide complete design calculations for mechanical systems. Include computations for sizing equipment, compressed air systems, air duct design, and U-factors for ceilings, roofs and exterior walls and floors.
- (2) Employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation is required. Based on the results of calculations, provide a complete list of the materials and equipment proposed with the manufacturer's published cataloged product installation specifications and roughing-in data.

##### b. Drawings:

- (1) On the floor plans, show all principle architectural features of the building which affect the mechanical design.
- (2) Provide Mechanical legend with applicable abbreviations and notes.
- (3) Locate and size all ductwork and piping on the drawings. Separate drawings for HVAC piping and plumbing piping must be provided.
- (4) Locate and identify all thermostat and other sensors.
- (5) Locate all mechanical equipment on the drawings.
- (6) Submit complete HVAC controls equipment schedules, sequences of operation, wiring and logic diagrams, Input/Output Tables, equipment schedules, and all associated information.
- (7) Provide construction details, sections, elevations, etc., only where required for clarification of methods and materials of design.
- (8) Provide complete equipment schedules with all salient characteristics.

##### c. Specifications:

Submit complete set of final specifications and revised for the project for review.

#### 3.2.4.9 Interior Electrical System

In addition to the items listed in the previous submittal, the following items are required:

- a. Design Analysis: A coordination study with appropriate curves must be provided to show that all protective devices have been fully coordinated. Completed short circuit calculations for the entire electrical system must be provided. All equipment must be identified by manufacturer's name and catalog number.

Complete voltage drop and lighting calculations must be provided. The voltage drop calculations must use the same single line diagram as the short circuit calculations and must show drops at the same locations as short circuit currents are shown. Lighting calculations using the zonal cavity method must be provided for all rooms and spaces requiring illumination.

The design narrative must be an updated version of the 65% submittal but must reflect the design as submitted. The aforementioned calculations must be included with the narrative. The calculations and coordination study must have the seal of the registered engineer who performed the same affixed to the cover sheet. Previous calculations such as short circuit, voltage drop, lighting, cable tray fill, load letter, and cable tray fill shall be updated from the 65% submission, as well as the cutsheets for the basis of design.

- b. Drawings: All details must be completed. Congested areas must be shown by enlarged drawings.

The drawings must be thoroughly checked against the other disciplines to ensure that the proper electrical connections are provided for equipment and there are no conflicts between the location of electrical equipment and equipment by other disciplines.

- c. Specifications: Specification sets must be complete with all edits incorporated and coordinated.

#### 3.2.4.10 Exterior Electrical Distribution System

In addition to the items listed in the previous submittal, the following items are required:

- a. Design Analysis: A coordination study with appropriate curves must be provided to show that ALL protective devices have been fully coordinated. Completed short circuit calculations for the entire electrical system must also be provided. All equipment must be identified by manufacturer's name and catalog number.

Complete voltage drop and lighting calculations must be provided. The voltage drop calculations must use the same single line diagram as the short circuit calculations, and must show drops at the same locations as short circuit currents are shown. Lighting calculations using the point-to-point method must be provided for all exterior locations requiring illumination.

The design narrative must be an updated version of the 65% submittal but must reflect the final design. Calculations must be included with the narrative. The calculations and coordination study must have the seal of the registered engineer who performed them affixed to the cover sheet.

- b. Drawings: The drawings are a completed version of the 65% design drawings with all comments and any other changes incorporated.

All details must be completed. Congested areas must be shown by enlarged drawings.

The drawings must be thoroughly checked to ensure that the proper electrical connections are provided for equipment and there are no conflicts between the location of electrical equipment and equipment of other disciplines.

- c. Specifications: Specification sets must be complete with all edits incorporated and coordinated.

#### 3.2.4.11 Electronic Systems

- a. Design Analysis: The design narrative and drawings must be updated of the 65% submittal to reflect the final design. Complete calculations must be included with the narrative. All electronic systems must be fully detailed and coordinated. All equipment must be identified by manufacturer's name and catalog number.
- b. Drawings: The drawings must be thoroughly checked against the other disciplines to ensure that all equipment is provided with the proper connections and there are no conflicts with other elements.
- c. Specifications: Specification sets must be complete with all edits incorporated and coordinated.

#### 3.2.5 Design Complete Submittals

After the final design submission and review conference for a design package, revise the design package to incorporate the comments generated and resolved in the final review conferences, perform and document a back-check review and submit the final, design complete documents, which represents released for construction documents.

### 3.3 DESIGN PLATFORM AND FILE FORMATS

Design the project using the systems and platforms defined below:

#### 3.3.1 BIM

The BIM submittal format is Autodesk Revit Version 2021. Provide the BIM submittals as fully operable, compatible, and editable within the native BIM/CIM tools.

#### 3.3.2 CIM

The CIM submittal format is Autodesk Civil 3D version 2021. Provide the CIM submittals as fully operable, compatible, and editable within the native BIM/CIM tools.

#### 3.3.3 CAD

##### 3.3.3.1 Native CAD Authoring Content

All content produced through CAD authoring software outside of any object/element based BIM or CIM platform must be compliant with ERDC/ITL TR-19-6 and ERDC/ITL TR-19-7. Autodesk AutoCAD Template Files. Download from the CAD/BIM Technology Center website as part of the A/E/C

Work Structure.

### 3.3.3.2 CAD Extracted From BIM/CIM Authoring Platforms

Provide editable CAD sheet files extracted from the BIM or CIM files. CAD content exported from a BIM or CIM modeling platform must comply with ERDC/ITL TR-19-6 and NCS BIM Implementation section, part "2.0 Clarifications."

## 3.4 ADVANCED MODELING REQUIREMENTS

### 3.4.1 BIM and CIM Modeling Requirements

#### 3.4.1.1 Minimum Modeling Requirements

Model to the requirements of the USACE M3 as identified in the approved Advanced Modeling PxP.

#### 3.4.1.2 Graphics and Layer Standards

- a. All content produced with object/element based BIM and CIM authoring software platforms must be compliant with ERDC/ITL TR-19-6.
- b. All content produced with layer-centric BIM or CIM authoring software must be compliant with ERDC/ITL TR-19-7 and ERDC/ITL TR-19-6.

#### 3.4.1.3 USACE Platform Configuration Standards

USACE Revit Templates, Version current at the time of signing the contract to start construction. Download from the USACE CAD/BIM Technology Center website and, if required, upgrade to the Contract approved software version.

#### 3.4.1.4 Classification

Include Facility Data referencing one or more classification system(s) identified in the M3 for all modeled elements.

#### 3.4.1.5 Space/Room Data

In the model, include spatial data defining actual net square footage and data to develop the room finish schedule, including room names and numbers. Include program information to verify design space against programmed space, using this information to validate area quantities.

#### 3.4.1.6 Modeling Schedules

Comply with the NCS BIM Implementation section, part "2.4 Schedules." Produce schedules from, and link to, the Facility/Site Data within the Model. Document any exceptions in the PxP and submit for review.

#### 3.4.1.7 Details and Enlarged Sections

Comply with the NCS BIM Implementation section, part "3.2 Model Coordination and Delivery." Derive all details and enlarged sections necessary for construction from the Model when possible. For those details and enlarged sections not derived directly from the Model, verify that geometry and data depicting the details and enlarged sections are

consistent with Model elements. Details with significant drafted content such as 'standard' and 'typical' details cannot contradict the model and must utilize the model as an underlay when possible for the purposes of verification and coordination. Three dimensional, isometric, and section isometric details derived from the model are preferred. Create details and enlarged sections that are not derived from the Model using native authoring tools within the Model or be embedded within the Model.

#### 3.4.1.8 Drawing Indices

Comply with the NCS BIM Implementation section, part "2.3 Sheet Organization." Where BIM authoring platform supports it, derive drawing indices from a model-driven schedule.

#### 3.4.2 CAD

All content produced through layer-centric CAD authoring software outside of any object/element based BIM or CIM platform must be compliant with ERDC/ITL TR-19-7 and ERDC/ITL TR-19-6.

Autodesk AutoCAD Civil 3D Template Files. Download form the CAD/BIM Technology Center website as part of the A/E/C Work Structure.

### 3.5 DESIGN CONFIGURATION MANAGEMENT (DCM)

#### 3.5.1 Procedures

Develop and maintain effective, DCM procedures to control and track all revisions to the design documents subsequent to the Interim Design Submission and continuing through submission of the As-Built documents. After the final design is accepted, this process provides control of and documents revisions to the accepted design (See Special Contract Requirement: Deviating From the Accepted Design). Submit the DCM procedures within the Design Quality Control Plan.

- a. Include authorities and concurrences in the DCM system to authorize revisions, including documentation as to why the revision is required.
- b. An internal system may be used with interactive Government concurrences or the Government's "Dr Checks Design Review and Checking System" may be used.
- c. Make the DCM data available to the Government reviewers at all times.

#### 3.5.2 Tracking Design Review Comments

Although an internal system for overall design configuration management is allowed, use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design review comments.

The Government will set up the project in DrChecks. Throughout the design process parties enter, track, and back-check comments using the DrChecks system. Designers of Record annotate comments timely and specifically to indicate exactly the action to be taken or why the action is not required. After the design review conference and prior to the next design submittal for the package, the DORs annotate those comments that require DOR action or design revision to show how and where it has been addressed in the design documents. These procedures are part of the required design configuration management plan. Flag comments considered critical by the

conference participants.

#### 3.5.2.1 DrChecks Initial Account Set-Up

Identify a contact person within the office to act as the administrator for all Contractor personnel, including subcontractors, that will be accessing the PROJNET Dr Checks system. Through the Contracting Officer, coordinate with the Project Manager and the District PROJNET administrator for system access, system instruction and comment process instructions.

PROJNET contains an introductory file and other tutorial material that can be accessed once user accounts have been established. Upon log in, select Portals/User Documentation.

#### 3.5.2.2 DrChecks Review Comments

Annotate and resolve all comments prior to the next submittal. Include the DrChecks comments and responses in the design analysis for record in the next design submittal for the package.

- a. Upon review of comments prior to the design review conference, the DOR(s) evaluate the comments. Include exactly what action will be taken or why action is not required.
- b. After the review conference, the DOR(s) formally respond to each applicable comment in DrChecks a second time, prior to the next submittal, clearly indicating what action was taken and what drawing/spec/analysis changed. Designers of Record are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next design submittal, reviewers will back-check answers to the comments against the new submittal, in addition to reviewing additional design work.
- c. Clearly annotate in DrChecks those comments that require effort outside the requirements of the contract. Do not proceed with work outside the contract until a modification to the contract is properly executed.

### 3.6 INTERIM DESIGN REQUIREMENTS

At least two interim design submittals, review and review conferences is required for each design package (except that the Contractor may, upon Government approval, skip the interim design submission and proceed directly to final design of the sitework and utilities package). Additional interim design conferences or over-the-shoulder reviews may be scheduled, as needed, to assure continued Government concurrence with the design work. Include the interim submittal review periods and conferences in the Section 01 32 01.00 10 PROJECT SCHEDULE and indicate in periodic schedule updates what part of the design work is at what percentage of completion. See also paragraph INTERIM DESIGN DEVELOPMENT REVIEW WAIVER for a waiver to the formal interim design review.

#### 3.6.1 Submission Review

After receipt of an Interim Design submission, the Government requires 14 calendar days after receipt of the submission to review and comment on the interim design submittal. For smaller design packages, especially those that involve only one or a few separate design disciplines, the parties

may agree on a shorter review period or alternative review methods (e.g., over-the-shoulder or electronic file sharing), through the partnering process.

- a. For each interim design review submittal, the Contracting Officer will furnish a single consolidated, validated set of comments from the various design sections and from other concerned agencies involved in the review process using the DrChecks Design Review and Checking System. The review will be for conformance with the technical requirements of the Contract.
- b. The Government reserves the right to reject design document submittals if comments are deemed significant.
- c. Furnish disposition of all comments, in writing, through DrChecks. If there are technical disagreements with any comments, clearly outline, with justification, the reasons for disagreement and noncompliance within five calendar days after receipt of these comments.
- d. The Contractor is cautioned that if it believes the action required by any comment exceeds the requirements of this contract, that it should take no action and notify the Contracting Officer in writing immediately.

### 3.6.2 Interim Review Conference

Hold an Interim Review conference for each design submittal at either the installation or as agreed upon as part of the partnering process. Attendees include, at a minimum, the DOR(s) involved in development of the design submittal. Schedule the conference to take place the week after the receipt of the comments. Notify the Contracting Officer of any comments that with concurrence would require further design development.

For smaller fast-track packages that involve only a few reviewers, the parties may agree to alternative conferencing methods, such as teleconferencing, or televideo, where available, as determined through Partnering.

### 3.6.3 Conference Documentation

#### 3.6.3.1 Minutes and Comment Process

Provide meeting minutes within two work days after the conference adjourns, and enter final resolution of all comments into DrChecks. Include copies of comments, annotated with comment action agreed on, with the minutes.

- a. Resolve issues remaining open after the conference adjourns by immediate follow-on action to close the issue within 30 calendar days.
- b. Incorporate comments as agreed upon during the conference.

#### 3.6.3.2 Availability

In order to facilitate the Government code and contract conformance reviews, identify, track resolution of, and maintain all comments and action items generated during the design review process. Make this available to the designers and reviewers prior to the subsequent design reviews.

### 3.7 FINAL DESIGN REQUIREMENTS

Provide final design submittals that consist of 100 percent complete drawings, specifications, submittal register, design analyses for Government review and acceptance.

- a. Include any permits required by the contract for each package submitted.
- b. In order to expedite the final design review, prior to the conference, ensure that the design configuration management data and all review comment resolutions are up-to-date.
- c. Perform independent technical reviews and back-checks of previous comment resolutions, as required by Section 01 45 00.00 10 QUALITY CONTROL.

#### 3.7.1 Design Drawings

Submit drawings complete with all contract requirements incorporated into the documents to provide a 100 percent design for each package submitted. In addition to all native Advanced Modeling files, provide separate electronic files in a PDF format.

##### 3.7.1.1 Geo-Referenced Data

Capture geo-referenced coordinates of all changes that will be made to the existing site (facility footprint, utility line installations and alterations, roads, parking areas, etc) as a result of this contract.

Close-out requirements at the as-built stage, require final geo-referenced GIS Database of the new facility along with all exterior modifications. The Government will incorporate this data set into the Installation's GIS Masterplan or Enterprise GIS System. See also, Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 3.7.2 Design Analysis

Provide a design analysis with calculations necessary to validate and support all design work submitted. Expand and advance calculations and information presented in the interim design stage to the current level of design. The responsible DOR(s) stamp, sign and date the design analysis.

#### 3.7.3 Specifications

Provide specifications 100 percent complete and in final form.

#### 3.7.4 Submittal Register

Provide an updated, cumulative submittal register with each design package that identifies the design and construction submittals required by that design package.

#### 3.7.5 Preparation of DD Form 1354 (Transfer of Real Property)

This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the



Installation's inventory of real property. The Government will furnish the Contractor's design manager a DD Form 1354 checklist to use to produce a draft Form 1354. Submit the completed checklist and prepared draft Form DD 1354 with the 100 percent design. The Government will use these documents to complete interim and final DD 1354s for turnover of a portion or all of the construction project.

### 3.7.6 Furniture, Fixtures, and Equipment (FF&E)e

The Design Build Contractor shall provide design services that coordinate the Structural Interior Design (SID) with the Furniture, Fixtures, and Equipment (FF&E) requirements to produce a complete Comprehensive Interior Design (CID) as defined within UFC 3-120-10, Interior Design. Furniture, Fixtures and Equipment (FF&E) includes selection, layout, specification and documentation of all FF&E items, including workstations, seating, storage, filing, visual display items, accessories, window treatment, and artwork, to facilitate pricing, procurement and installation. Selection shall include furniture finishes, materials and colors coordinated with building finishes. The A-E's Interior Designer (ID) shall submit an itemized furniture procurement package for review and approval by the Government, formatted for use by the Contractor to purchase and install the FF&E. Upon completion, and acceptance of the Furniture Procurement (FF&E) package by the Government, the procurement package shall become property of the Government.

### 3.8 DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS

After the Final Design Submission and Review Conference, revise the design documents for the design package to incorporate the comments generated and resolved in the final review conference. Perform and document a back-check review and submit the final, design complete documents. The deliverable includes all documentation and supporting design analysis in final form, as well as the final review comments, disposition and the back-check. As part of the quality assurance process, the Government may perform a review of the released for construction documentation. Promptly correct any errors or omissions found during the Government review.

### 3.9 ACCEPTANCE AND RELEASE FOR CONSTRUCTION

After acceptance of the Design Complete Construction Document(s) the Contracting Officer will allow construction to start for that design package.

Government review and acceptance of design submittals is for contract conformance only and does not relieve the Contractor from responsibility to fully adhere to the requirements of the contract, including the Contractor's accepted proposal, or limit the Contractor's responsibility of design as prescribed under Special Contract Requirement:

"Responsibility of the Contractor for Design" or limit the Government's rights under the terms of the contract. The Government reserves the right to rescind inadvertent acceptance of design submittals containing contract deviations not separately and expressly identified in the submittal for Government consideration and approval.

-- End of Section --

SECTION 01 33 29

SUSTAINABILITY REQUIREMENTS AND REPORTING

02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

HPSB Guiding Principles (2020) Guiding Principles for Sustainable Federal Buildings and Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

INTERNATIONAL CODE COUNCIL (ICC)

ICC IGCC (2018) International Green Construction Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

FSRIA 9002 Farm Security and Rural Investment Act Section 9002 (USDA BioPreferred Program)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-02 (2020) High Performance and Sustainable Building Requirements

UFC 3-210-10 (2015; with Change 3, 2020) Low Impact Development

UFC 3-600-01 (2016; with Change 5, 2020) Fire Protection Engineering for Facilities

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 SUMMARY

This section includes requirements for Sustainability documentation and reporting submittals per the federally mandated High Performance and Sustainable Building (HPSB) or HPSB "Guiding Principles" (GP) in accordance with UFC 1-200-02 High Performance and Sustainable Building Requirements, and other identified requirements.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Preliminary High Performance and Sustainable Building Checklist; G, AE/GA, S

Sustainability Action Plan; G, AE/GA, S

Preliminary Sustainability eNotebook; G, AE/GA

#### SD-05 Design Data

Interim Design High Performance and Sustainable Building Checklist; G, AE/GA, S

Interim Design Sustainability eNotebook; G, AE/GA

Final Design High Performance and Sustainable Building Checklist; G, AE/GA, S

Final Design Sustainability eNotebook; G, AE/GA

#### SD-06 Test Reports

#### SD-11 Closeout Submittals

Final High Performance and Sustainable Building Checklist; G, GA, S

Final Sustainability eNotebook; G, GA

Amended Final Sustainability eNotebook; G, GA

Amended Final High Performance and Sustainable Building Checklist; G, GA, S

### 1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Provide the following sustainability activities and documentation to verify achievement of HPSB Guiding Principles Validation (GPV):

- a. Analysis of each Guiding Principle Requirement and how project complies. Include final government approved narrative(s) in the HPSB Checklist submittal.
- b. No changes to the HPSB Checklist are allowed without approval from the Contracting Officer, in accordance with Section 01 33 00 SUBMITTAL REQUIREMENTS. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved HPSB Guiding Principles Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or

improves the building performance.

- c. Documentation of all work required to incorporate the applicable HPSB Guiding Principles requirements indicated on the HPSB Checklist and in this contract, including all "S" submittals.
- d. Sustainability Action Plan.
- e. Design and construction related documentation for the project Sustainability eNotebook and keep updated with regularly-scheduled Construction Quality Control Meetings. Include design and construction related documentation containing the following components:
  - (1) HPSB Checklist(s)
  - (2) Sustainability Action Plan
  - (3) Documentation illustrating HPSB Guiding Principles Requirements compliance, including "S" submittals

#### 1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

- a. Analysis of each HPSB Guiding Principles Requirement and how project will comply. Final government approved narrative(s) must be included in the HPSB Checklist submittal.
- b. Name and contact information for: Contractor's Point of Contact (POC) ensuring sustainability goals are accomplished and documentation is assembled.
- c. Indoor Air Quality plan.

#### 1.4.2 Calculations

Provide all design data, calculations, product data, labels and product certifications required in this specification to demonstrate compliance with the HPSB Guiding Principles Requirements.

### 1.5 SUSTAINABILITY SUBMITTALS

Provide HPSB Checklist and other documentation in the Sustainability eNotebook to indicate compliance with the sustainability requirements of the project.

#### 1.5.1 High Performance Sustainable Building (HPSB) Checklist

Provide construction documentation that provides proof of, and supports compliance with, the completed HPSB Checklist.

##### 1.5.1.1 HPSB Checklist Submittals

Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Include the final HPSB Checklist(s) with the interim DD1354 Real Property Record Submittal.

#### 1.5.2 "S" Submittals for Sustainability Documentation

"S" submittals are the sustainability documentation requirements cited in the various sections of this contract. Submit the GPV sustainability documentation required in this section as "S" submittals in all affected UFGS Sections.

- a. Highlight GPV compliance data in "S" submittal.
- b. Add "S" submittals to the Sustainability eNotebook only after submittal approval, and bookmark them as required in paragraph SUSTAINABILITY ENOTEBOOK below.
- c. Ensure all approved "S" submittals are included in each Sustainability eNotebook submittal.

#### 1.5.3 Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved HPSB checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Include all required data in Sustainability eNotebook, to support full compliance with the HPSB Guiding Principles Requirements, including:

- a. HPSB checklist
- b. Sustainability Action Plan
- c. Calculations
- d. Labels
- e. "S" submittals
- f. Certifications, assessments, or validations and compliance report

##### 1.5.3.1 Sustainability eNotebook Format

Provide Sustainability eNotebook in the form of an Adobe PDF file; bookmark each HPSB Guiding Principles Requirement, and sub-bookmark at each document. Match format to HPSB Guiding Principles numbering system indicated herein. Maintain up-to-date information, such as spreadsheets, templates, with each current submittals.

Contracting Officer may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current and on track per project goals.

##### 1.5.3.2 Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

- a. Preliminary Sustainability eNotebook

Submit preliminary Sustainability eNotebook with updated Preliminary High Performance and Sustainable Building Checklist at the first post

award meeting in accordance with Section 01 30 00 ADMINISTRATIVE REQUIREMENTS.

b. Interim Design Sustainability eNotebook

Submit updated Sustainability eNotebook with updated Interim Design High Performance and Sustainable Building Checklist with the final design. If issues relating to achieving the sustainability goals of the project are subsequently identified, identify reasons and mitigation from DOR, and resubmit to the Contracting Officer for approval.

c. Final Design Sustainability eNotebook

Submit updated Sustainability eNotebook with updated Final Design High Performance and Sustainable Building Checklist with the final design. If issues relating to achieving the sustainability goals of the project are subsequently identified, identify reasons and mitigation from DOR, and resubmit to the Contracting Officer for approval.

e. Construction Quality Control Meetings.

Provide up-to-date GP in the Sustainability eNotebook for each meeting.

f. Final Sustainability eNotebook

Submit updated Sustainability eNotebook with updated Final High Performance and Sustainable Building Checklist at Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until Final Sustainability construction phase documentation is complete.

g. Amended Final Sustainability eNotebook

Amend and resubmit the Amended Final Sustainability eNotebook with Amended Final High Performance and Sustainable Building Checklist, to include post-occupancy corrections, updates, and requirements. Final progress payment retainage may be held by Contracting Officer until amended final sustainability documentation is complete. Submit the Amended Final Sustainability eNotebook Submittal on DVDs to the Contracting Officer no later than 30 days after final GP determination.

1.6 DOCUMENTATION REQUIREMENTS

a. Incorporate each of the following HPSB Guiding Principles requirements into project and provide documentation that proves compliance with each listed requirement. Items below are organized by HPSB Guiding Principles.

b. For each of the following paragraphs that require the use of products listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

1.6.1 Integrated Design Process

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

1.6.1.1 Design Submittal Documentation

- a. List the sustainability integrated design team, and a description of their roles in all stages of a project's planning and delivery:
  - (1) Include Contractor's Sustainability Coordinators; Architecture and Engineering disciplines involved on the project, and the DOR in charge of the overall project and each discipline; Construction Subcontractors and the company representatives that align with each architectural and engineering discipline, Planning, Public Works, Environmental Specialist and other appropriate installation personnel.
  - (2) Describe their roles and responsibilities and plan-of-action for how each team member will be involved to achieve the project sustainability requirements, and how the Contractor will coordinate with Government personnel.
  - (3) Maintain an up-to-date list with descriptions throughout the project.
- b. Provide narratives that:
  - (1) Indicate performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and life cycle of the building.
  - (2) Demonstrate integration of the goals into design and construction.
  - (3) Demonstrate collaboration with other providers, such as Commissioning Authority.

1.6.2 Commissioning (Cx)

Develop and incorporate Commissioning requirements into the documents, in accordance with Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING.

1.6.3 Optimize Energy Performance

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

1.6.3.1 Design Submittal Documentation

- a. Narrative that provides a summary of:
  - (1) The decision-making process leading to the selection of at least three energy-efficient solutions (for each system contributing to the energy footprint of the building) to be analyzed; and the selected design solution(s)
  - (2) The specific energy standard and version utilized; and the software used in the analysis
  - (3) The calculated energy consumption and energy use intensity (EUI in kBtu/sf/yr) of the baseline building and the proposed design alternatives

## Repair Steam Sterilization Plant (SSP)

- b. A minimum of the following energy modeling files and summaries for the baseline and proposed alternatives:

- (1) Input, schedules and libraries; and output
- (2) Calculated energy use by energy type
- (3) Calculated energy use by building system

### 1.6.3.2 Construction Submittal Documentation

Provide revised energy modeling for actual system constructed.

### 1.6.4 Energy Efficient Products

Provide only energy-using products that are Energy Star rated or have Federal Energy Management Program (FEMP) recommended efficiency. Where Energy Star or FEMP recommendations have not been established, provide most efficient products that are life-cycle cost-effective. Provide only energy using products that meet FEMP requirements for low standby power consumption. Energy efficient products can be found at:

<https://www.energy.gov/eere/femp/federal-energy-management-program> and <http://www.energystar.gov/>.

For construction submittal documentation, provide proof that product is labeled energy efficient and complies with the cited requirements.

### 1.6.5 Building-level Power Metering

Provide building-level meters for electricity, natural gas, and steam where applicable.

#### 1.6.5.1 Design Submittal Documentation

Provide design drawings that highlight meter locations on the site.

#### 1.6.5.2 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.6 Indoor Water Use

Provide Construction Documentation proof that fixtures are labeled EPA WaterSense, for products available with EPA WaterSense labeling; for all other fixtures, proof they comply with EPA WaterSense efficiency requirements.

### 1.6.7 Indoor Water Metering

Provide building-level meters for potable water use. Provide the requirements cited in the following paragraphs:

#### 1.6.7.1 Design Submittal Documentation

Provide design drawings that highlight meter locations on the site.



## Repair Steam Sterilization Plant (SSP)

### 1.6.7.2 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.8 Outdoor Water Use

Where new irrigation is required, provide only non-potable sources. Provide the requirements cited in the following paragraphs:

#### 1.6.8.1 Design Submittal Documentation

- a. Provide design drawings and analysis that identify the non-potable water source used and demonstrate the non-potable water source is appropriate for landscape irrigation.

#### 1.6.8.2 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.9 Outdoor Water Meters

Provide meters for outdoor systems that use potable water. Provide the requirements cited in the following paragraphs:

#### 1.6.9.1 Design Submittal Documentation

- a. Provide design drawings that highlight meter locations on the site.

#### 1.6.9.2 Construction Submittal Documentation

Provide manufacturer's data validating compatibility with base-wide system and component advanced meter requirements.

### 1.6.10 Alternative Water

Use alternative sources of water to replace potable water usage, when life-cycle cost-effective and to the extent permitted by local laws and regulations.

#### 1.6.10.1 Design Submittal Documentation

- a. Provide design drawings and calculations that demonstrate the alternative water sources used, potable water savings as compared to non-alternative water sourcing, and projected annual potable water savings.

### 1.6.11 Stormwater Management

Develop and incorporate stormwater requirements into the documents. Submit design and construction documentation required by UFC 3-210-10 and Service processes, as proof of this tracking requirement.

### 1.6.12 Ventilation and Thermal Comfort

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

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### 1.6.12.1 Design Submittal Documentation

Provide design drawings and calculations that demonstrate HVAC systems and the building envelope have been designed to meet the requirements.

### 1.6.13 Daylighting

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

#### 1.6.13.1 Design Submittal Documentation

- a. Provide floor plans and elevations.
- b. Provide design analysis delineating requirements, to include compliant reflective surface locations and shading devices (where applicable).

### 1.6.14 Moisture Control

Provide the following:

#### 1.6.14.1 Design Submittal Documentation

Provide drawings of building envelope details and HVAC humidity controls.

#### 1.6.14.2 Construction Submittal Documentation

Ensure construction materials are separated and protected in accordance with other sections in this contract document, with adequate humidity controls during construction. In accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, includes plan for ongoing building moisture control.

Coordinate with the moisture control requirements of Section 01 45 00.00 10 QUALITY CONTROL.

### 1.6.15 Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials)

Meet the requirements of Table 3-1 at the end of this specification.

For Construction submittal documentation, provide certifications or labels that demonstrate compliance with cited requirements, based on the attached TABLE 3-1.

### 1.6.16 Indoor Air Quality During Construction

Prior to construction, create indoor air quality plan. Develop and implement an IAQ construction management plan during construction and flush building air before occupancy.

For new construction, meet the requirements of ICC IGCC 1001.3.1.5 (10.3.1.4) Indoor Air Quality (IAQ) Construction Management.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and building air was flushed out in accordance with the cited standard.

#### 1.6.17 Recycled Content

Comply with 40 CFR 247. Refer to:

<https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program> for assistance identifying products cited in 40 CFR 247. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements.

##### 1.6.17.1 Construction Submittal Documentation

- a. Provide manufacturers' documents stating the recycled content by material, or written justification for claiming one of the exceptions allowed on the cited website.
- b. Substitutions: Submit for Government approval for proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. For all such proposed substitutions, submit with the Sustainability Action Plan accompanied by product data demonstrating equivalence.
- c. In order to complete compliance with FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA Designated Items, refer to submittal requirement for recycled/recovered material content in Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.18 Bio-Based Products

Provide products and materials composed of the highest percentage of bio-based materials (including rapidly renewable resources and certified sustainably harvested products), consistent with FSRIA 9002 USDA BioPreferred Program, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user and when available at a reasonable cost. Use only supplies and materials of a type and quality that conform to applicable specifications and standards.

Comply with FSRIA 9002 USDA BioPreferred Program. Refer to [www.biopreferred.gov](http://www.biopreferred.gov) for the product categories and BioPreferred Catalog. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation and must meet performance requirements. Provide the following documentation:

- a. USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.
- b. In order to complete compliance with FAR 52.223-1 Biobased Product Certification, refer to submittal requirement for biobased products in Section 01 78 00 CLOSEOUT SUBMITTALS, paragraphs CERTIFICATION OF EPA DESIGNATED ITEMS and CERTIFICATION OF USDA DESIGNATED ITEMS.

#### 1.6.19 Waste Material Management (Recycling - Design)

For the submittal documentation below, demonstrate compliance with UFC 1-200-02.

For design submittal documentation, provide drawing showing an appropriately sized and placed dedicated storage area for recyclables.

1.6.20 Waste Material Management (Recycling - Construction)

Divert demolition and construction debris in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1.6.21 Address Climate Change Risk

For design submittal documentation, provide narrative of decisions for design associated with scoped requirements.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

Provide sustainability focus and coordination at all meetings to achieve sustainability goals. Coordinate meeting requirements with other UFGS Sections meeting requirements in this project. Review GP sustainability requirements, HPSB Checklist, Sustainability Action Plan, and completeness status of Sustainability eNotebook at the following meetings:

- a. Pre-Construction Conference
- b. Construction Quality Control Meetings

Refer to Section 01 30 00 ADMINISTRATIVE PROCEDURES for Post Award Meetings.

- c. Post Award Meeting
- d. Design Quality Assurance Meetings
- e. Design Complete Review Meetings

Conduct review no later than 60 days after final design complete submission and identify any outstanding issues that affect correct completion of all documentation requirements, and actions that will achieve requirements. Conduct corrective actions.

- g. Facility Turnover Meetings

Conduct review no later than 60 days before final turnover and identify any outstanding issues that affect correct completion of all documentation, assessment or validation, and actions that will achieve requirements. Conduct corrective actions prior to turnover, to ensure all requirements are achieved.

## 3.2 TABLE 3-1 VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS) REQUIREMENTS

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	EMISSIONS REQUIREMENTS
Adhesives and Sealants	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Adhesives (carpet, resilient, wood flooring; base cove; ceramic tile; drywall and panel; primers) Sealants (acoustical; firestop; HVAC Air duct; primers) Caulks	SCAQMD Rule 1168 (Use "other" category for HVAC duct sealant) (for firestop adhesive, UFC 3-600-01 overrides conflicting requirements)
			Aerosol adhesives	Section 3 of Green Seal Standard GS-36 (except: cleaners, solvent cements, and primers used with plastic piping and conduit in plumbing, fire suppression, and electrical systems; HVAC air duct sealants when the application space air temp is less than 40 F (4.5 C)).

**TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements**

Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)

<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Paints and Coatings</b>	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Flat and nonflat, nonflat high-gloss, specialty, basement specialty, fire-resistive, floor, low-solids, rust preventative, wood, reflective wall coatings; concrete/masonry sealers; primers; sealers; undercoaters; shellacs (clear and opaque); stains; varnishes; conjugated oil varnish; lacquer; clear brushing lacquer	<b>Green Seal Standard GS-11</b>

**TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements**

Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)

<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Paints and Coatings</b>	<b>CDPH/EHLB/Standard method V1.1 (California Section 01350)</b> (Use "office" or "classroom" space limits for all applications)	or	Concrete curing compounds; dry fog, faux finishing, graphic arts (sign paints), industrial maintenance, mastic texture, metallic pigmented, multicolor, recycled coatings; pretreatment wash primers, reactive penetrating sealers; specialty primers, wood preservatives, and zinc primers	<b>California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings</b> or <b>SCAQMD Rule 1113r</b>
<b>Paints and Coatings</b>	<b>CDPH/EHLB/Standard method V1.1 (California Section 01350)</b> (Use "office" or "classroom" space limits for all applications)	or	High-temperature coatings; stone consolidants; swimming-pool coatings; tub- and tile-refining coatings; and waterproofing membranes	<b>California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings</b>

<b>TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements</b> Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)				
<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Floor Covering Materials</b>	For carpet, all locations: CDPH/EHLE/Standard Method V1.1 (California Section 01350) or label for Section 9 of CDPH/EHLE/Standard Method V1.1 (California Section 01350)		none	none
<b>Insulation</b>	CDPH/EHLE/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none



**TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements**

Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)

<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
<b>Composite Wood, Wood Structural Panel, and Agrifiber Products</b> , no added urea-formaldehyde resins including laminating adhesives for composite wood and agrifiber assemblies - particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, door cores	Third-party certification (approved by CARB) of <b>California Air Resource Board's (CARB) regulation</b> , Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products	or	none	<b>CDPH/EHLB/Standard method V1.1</b> (California Section 01350) (Use "office" or "classroom" space limits for all applications) (except: Structural panel components such as plywood, particle board, wafer board, and oriented strand board identified as "EXPOSURE 1," "EXTERIOR," or "HUD-APPROVED" are considered acceptable for interior use.)
<b>Office Furniture Systems and Seating</b> installed prior to occupancy	<b>ANSI/BIFMA X7.1</b> <b>ANSI/BIFMA X7.1:</b> (95-percent of installed office furniture system workstations and seating units)  <b>Section 7.6.2 of ANSI/BIFMA e3</b> (50-percent of office furniture system workstations and seating units)		none	none

<b>TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements</b> Source: ICC IGCC Chapter 8 (Materials) (Interior Applications Only)				
<b>MATERIAL CATEGORY</b>	<b>EMISSIONS REQUIREMENT</b>		<b>MATERIALS WITH ADDED VOC REQUIREMENT</b>	<b>EMISSIONS REQUIREMENTS</b>
Ceiling and Wall assemblies and systems including: acoustical treatments; ceiling panels and tiles; tackable wall panels and coverings; wall coverings; wall and ceiling paneling and planking	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none

-- End of Section --

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GOVERNMENTAL SAFETY REQUIREMENTS

11/20, CHG 3: 02/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.3	(2020) Tower Cranes
ASME B30.5	(2021) Mobile and Locomotive Cranes
ASME B30.7	(2021) Winches
ASME B30.8	(2020) Floating Cranes and Floating Derricks
ASME B30.9	(2018) Slings
ASME B30.20	(2018) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.23	(2016) Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
ASME B30.26	(2015; R 2020) Rigging Hardware

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.22	(2007; R 2017) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists
ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ASSP A10.44	(2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSP Z244.1	(2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods
ASSP Z359.0	(2018) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSP Z359.1	(2020) The Fall Protection Code
ASSP Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection

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Program

ASSP Z359.3	(2019) Safety Requirements for Lanyards and Positioning Lanyards
ASSP Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ASSP Z359.6	(2016) Specifications and Design Requirements for Active Fall Protection Systems
ASSP Z359.7	(2019) Qualification and Verification Testing of Fall Protection Products
ASSP Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSP Z359.12	(2019) Connecting Components for Personal Fall Arrest Systems
ASSP Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSP Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSP Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ASSP Z359.16	(2016) Safety Requirements for Climbing Ladder Fall Arrest Systems
ASSP Z359.18	(2017) Safety Requirements for Anchorage Connectors for Active Fall Protection Systems
ASSP Z490.1	(2016) Criteria for Accepted Practices in Safety, Health, and Environmental Training
ASTM INTERNATIONAL (ASTM)	
ASTM F855	(2019) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE 1048	(2016) Guide for Protective Grounding of Power Lines
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 51B	(2019; TIA 20-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222	(2018H; Add 1 2019) Structural Standard for Antenna Supporting Structures and Antennas and Small Wind Turbine Support Structures
TIA-1019	(2012; R 2016) Standard for Installation, Alteration and Maintenance of Antenna Supporting Structures and Antennas

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.333	Selection and Use of Work Practices
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1915.89	Control of Hazardous Energy (Lockout/Tags-Plus)
29 CFR 1926	Safety and Health Regulations for Construction

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29 CFR 1926.16	Rules of Construction
29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection
29 CFR 1926.552	Material Hoists, Personal Hoists, and Elevators
29 CFR 1926.553	Base-Mounted Drum Hoists
29 CFR 1926.1400	Cranes and Derricks in Construction
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 02-01-056	(2014) Inspection Procedures for Accessing Communication Towers by Hoist
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

### 1.2 DEFINITIONS

#### 1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

#### 1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person requirements, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has

been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSP Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented including experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

#### 1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the training material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

#### 1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

#### 1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

#### 1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

#### 1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even when provided by a physician or registered personnel.

#### 1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

#### 1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or load handling equipment. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e. ground or rail), the load's rigging path, the lift and rigging procedure.

#### 1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

#### 1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the definition requirements of EM 385-1-1 Appendix Q, and ASSP Z359.2 standard, having a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

#### 1.2.16 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

- a. Death, regardless of the time between the injury and death, or the length of the illness;
- b. Days away from work (any time lost after day of injury/illness onset);
- c. Restricted work;



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- d. Transfer to another job;
- e. Medical treatment beyond first aid;
- f. Loss of consciousness; or
- g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above

### 1.2.17 Government Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

### 1.2.18 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap using the Crane High Hazard working group mishap reporting form.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

#### SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G

LHE Inspection Reports

#### SD-07 Certificates

Crane Operators/Riggers

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Critical Lift Plan; G

Activity Hazard Analysis (AHA)

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

### 1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher.

### 1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with the most recent edition of USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

### 1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

#### 1.6.1 Personnel Qualifications

##### 1.6.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety program and Government-accepted Accident Prevention Plan. The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in the AHA may be used in lieu of an Alternate SSHO, and must be on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

##### 1.6.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

The SSHO may also serve as the Quality Control Manager. The SSHO may not serve as the Superintendent.

The SSHO must have completed a 40 hour contract safety awareness course based on the content and principles of EM 385-1-1, and instructed in accordance with the guidelines of ASSP Z490.1, by a trainer meeting the qualifications of paragraph QUALIFIED TRAINER REQUIREMENTS. If the SSHO does not have a current certification, certification must be obtained within 60 days, maximum, of Contract award.

#### 1.6.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with EM 385-1-1, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e. competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted Accident Prevention Plan, must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the Contracting Officer for information in consultation with the Safety Office.

##### 1.6.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1, Section 34.

##### 1.6.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of EM 385-1-1, Section 22.B.02 and herein.

##### 1.6.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04, 21.B.03, and herein.

#### 1.6.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40 hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.450, Subpart L.

Instructors are required to:

- a. Prepare class presentations that cover construction-related safety requirements.
- b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least five years. This is a certification class and must be attended

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100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.

- c. Update training course materials whenever an update of the EM 385-1-1 becomes available.
- d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.
- e. Request, review and incorporate student feedback into a continuous course improvement program.

### 1.6.1.4 Crane Operators/Riggers

Provide Operators, Signal Persons, and Riggers meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators and Signal Persons. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a Government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

### 1.6.2 Personnel Duties

#### 1.6.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.
- c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.
- f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.
- i. Maintain a list of hazardous chemicals on site and their material

Safety Data Sheets (SDS).

- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

Superintendent, QC Manager, and SSHO are subject to dismissal if the above or any other required duties are not being effectively carried out. If either the Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

### 1.6.3 Meetings

#### 1.6.3.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, Site Safety and Occupational Health Officer, quality control manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the Contract. This list of proposed AHAs will be reviewed and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin until an APP is established that is acceptable to the Contracting Officer.

#### 1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors at the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

## 1.7 ACCIDENT PREVENTION PLAN (APP)

Provide a site-specific Accident Prevention Plan (APP), including Activity Hazard Analyses (AHA), in accordance with EM 385-1-1 Appendix A, for the design team to follow during site visits and investigations. For subsequent visits, update the plan if there are changes in the personnel who will be attending, or the tasks to be performed. Submit the APP for review and acceptance by the Government at least 15 calendar days prior to the start of the design field work. Field work may not begin until the design APP is accepted by the Contracting Officer.

If the design scope includes borings or other subsurface investigations, include in the APP the type of field investigation and verification techniques, such as visual, local utility locating service scanning and third party/subcontractor scanning, potholing, or hand digging within two feet of a known utility that will be required. Mark underground utilities before starting any ground-disturbing actions. Notify the Contracting Officer 15 days prior to the start of soil borings or sub-surface investigations.

Prior to the start of construction incorporate the Design APP into the Construction APP so that one site specific APP exists for the project and submit to the Contracting Officer for acceptance.

### 1.7.1 APP - Construction

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor Quality Control Manager, and any designated Certified Safety Professional (CSP) or Certified Health Physicist (CIH). The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer within 30 calendar days of Contract award and not less than 10 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the

APP and attachments will be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e. imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSP A10.34), and the environment.

#### 1.7.2 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

- a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.
- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

#### 1.7.3 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

##### 1.7.3.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this Contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by Contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

##### 1.7.3.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if

duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made. Maintain historical SLPs for a minimum of three months.

#### 1.7.3.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. In addition, Critical Lift Plans are required for the following:

- a. Lifts over 50 percent of the capacity of barge mounted mobile crane's hoist.
- b. When working around energized power lines where the work will get closer than the minimum clearance distance in EM 385-1-1 Table 16-1.
- c. For lifts with anticipated binding conditions.
- d. When erecting cranes.

##### 1.7.3.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

##### 1.7.3.3.2 Lifts of Personnel

In addition to the requirements of EM 385-1-1, Section 16.H.02, for lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

##### 1.7.3.4 Multi-Purpose Machines, Material Handling Equipment, and Construction Equipment Lift Plan

Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Written approval from a qualified registered professional engineer, after a safety analysis is performed, is allowed in lieu of the OEM's approval. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

##### 1.7.3.5 Fall Protection and Prevention (FP&P) Plan

The plan must be in accordance with the requirements of EM 385-1-1, Section 21.D and ASSP Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training



requirements, and monitoring methods. Review and revise, as necessary, the Fall Protection and Prevention Plan documentation as conditions change, but at a minimum every six months, for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Plan documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Plan documentation in the Accident Prevention Plan (APP).

#### 1.7.3.6 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSP Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

#### 1.7.3.7 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12, 29 CFR 1910.147, 29 CFR 1910.333, 29 CFR 1915.89, ASSP Z244.1, and ASSP A10.44. Submit this HECP as part of the Accident Prevention Plan (APP). Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

#### 1.7.3.8 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A and Section 31 00 00 EARTHWORK.

### 1.8 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

#### 1.8.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

#### 1.8.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOV must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

### 1.9 DISPLAY OF SAFETY INFORMATION

#### 1.9.1 Safety Bulletin Board

Prior to commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.07. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

#### 1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

- a. Date deficiency identified;
- b. Description of deficiency;
- c. Name of person responsible for correcting deficiency;
- d. Projected resolution date;
- e. Date actually resolved.

#### 1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

#### 1.11 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. Government has no responsibility to provide emergency medical treatment.

#### 1.12 NOTIFICATIONS and REPORTS

##### 1.12.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, or any property damage. For LHE or rigging mishaps, notify the Contracting Officer as soon as practical but not more than four hours after mishap. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface); and underwater diving. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.

##### 1.12.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable USACE Accident Report Form 3394, and provide the report to the Contracting Officer within 5 calendar days of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. Near Misses: For Army projects, report all "Near Misses" to the GDA, using local mishap reporting procedures, within 24 hrs. The Contracting Officer will provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.
- c. Conduct an accident investigation for any load handling equipment accident (including rigging accidents) to establish the root cause(s) of the accident. Complete the LHE Accident Report (Crane and Rigging Accident Report) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer will provide a blank copy of the accident report form.

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### 1.12.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

### 1.12.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this Contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

### 1.13 HOT WORK

#### 1.13.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e. welding or cutting) or operating other flame-producing/spark producing devices, from the Fire Division. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with NFPA 51B and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

#### 1.13.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1, Section 06.H

### 1.14 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer

and Radiation Safety Office (RSO) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on Government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

#### 1.14.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead. The Contracting Officer will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

#### 1.14.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma radiography materials and equipment, a Government escort is required for any travels on the Installation. The Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

#### 1.14.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

#### 1.14.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

#### 1.14.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

#### 1.14.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety Officer (RSO) of any Radioactive Material use.

#### 1.14.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

#### 1.14.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

### 1.15 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with Section 34 of EM 385-1-1, OSHA 29 CFR 1926, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, and OSHA Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

#### 1.15.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

#### 1.15.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

#### 1.15.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible

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alarm for toxic gas detection.

### 1.15.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

### 1.16 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

- a. Secure outside equipment and materials and place materials that could be damaged in protected areas.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

### 1.17 PUBLIC HEALTH EMERGENCIES

In the event of a declared public health emergency, follow safety precautions as required by the Occupational Safety and Health Administration (OSHA) and the Centers for Disease Control and Prevention (CDC). Information can be found at [www.osha.gov](http://www.osha.gov) and [www.cdc.gov](http://www.cdc.gov) respectively.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

- a. Hard Hat
- b. Long Pants
- c. Appropriate Safety Shoes
- d. Appropriate Class Reflective Vests

### 3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. Develop an employee check-in/check-out communication procedure to ensure employee safety.

### 3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

### 3.1.3 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If material(s) that may be hazardous to human health upon disturbance are encountered during construction operations, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4 Changes and FAR 52.236-2 Differing Site Conditions.

## 3.2 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages at least 15 days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation). Some examples of energy isolation devices and procedures are highlighted in EM 385-1-1, Section 12.D. In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of HEC and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1, Section 11.A.02 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the



permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

### 3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1, Section 12.A. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Installation representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HEC training in accordance with EM 385-1-1, Section 12.C. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

### 3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, ASSP A10.44, NFPA 70E, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

#### 3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1, Section 12.A.02. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

#### 3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1, Sections 05.I and 11.B. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1, Section 12.E.06.

#### 3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, Section 12.E.08, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide

formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

### 3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSP Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

#### 3.5.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards and using personal fall protection equipment. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and ASSP Z359.2 in the AHA.

#### 3.5.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I, 29 CFR 1926.500 Subpart M, ASSP Z359.0, ASSP Z359.1, ASSP Z359.2, ASSP Z359.3, ASSP Z359.4, ASSP Z359.6, ASSP Z359.7, ASSP Z359.11, ASSP Z359.12, ASSP Z359.13, ASSP Z359.14, ASSP Z359.15, ASSP Z359.16 and ASSP Z359.18.

##### 3.5.2.1 Additional Personal Fall Protection Measures

In addition to the required fall protection systems, other protective measures such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1, Sections 21.0 through 21.0.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

##### 3.5.2.2 Personal Fall Protection Equipment

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The

use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

### 3.5.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

#### a. Low Sloped Roofs:

- (1) For work within 6 feet from unprotected edge of a roof having a slope less than or equal to 4:12 (vertical to horizontal), protect personnel from falling by the use of conventional fall protection systems (personal fall arrest/restraint systems, guardrails, or safety nets) in accordance with EM 385-1-1, Section 21 and 29 CFR 1926.500. A safety monitoring system is not adequate fall protection and is not authorized.
- (2) For work greater than 6 feet from the unprotected roof edge, addition to the use of conventional fall protection systems the use of a warning line system is also permitted, in accordance with 29 CFR 1926.500 and EM 385-1-1, Section 21.L.

#### b. Steep-Sloped Roofs: Work on a roof having a slope greater than 4:12 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also applies to residential or housing type construction.

### 3.5.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must be designed, installed, certified and used, under the supervision of a qualified person, for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

### 3.5.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

### 3.5.6 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP). The plan must be in accordance with the requirements of EM 385-1-1, ASSP Z359.2, and ASSP Z359.4.

## 3.6 WORK PLATFORMS

### 3.6.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

- a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.
- b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.
- c. An adequate gate is required.
- d. Employees performing scaffold erection and dismantling must be qualified.
- e. Scaffold must be capable of supporting at least four times the maximum intended load, and provide appropriate fall protection as delineated in the accepted fall protection and prevention plan.
- f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.
- g. Special care must be given to ensure scaffold systems are not overloaded.
- h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.
- i. Scaffolding other than suspended types must bear on base plates upon wood mudsills ( 2 in x 10 in x 8 in minimum) or other adequate firm foundation.
- j. Scaffold or work platform erectors must have fall protection during

the erection and dismantling of scaffolding or work platforms that are more than 6 feet.

- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

### 3.6.2 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

## 3.7 EQUIPMENT

### 3.7.1 Material Handling Equipment (MHE)

- a. Material handling equipment such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. Material handling equipment fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Material Handling Equipment Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N.
- c. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

### 3.7.2 Load Handling Equipment (LHE)

The following requirements apply. In exception, these requirements do not apply to commercial truck mounted and articulating boom cranes used solely to deliver material and supplies (not prefabricated components, structural steel, or components of a systems-engineered metal building) where the lift consists of moving materials and supplies from a truck or trailer to the ground; to cranes installed on mechanics trucks that are used solely in the repair of shore-based equipment; to crane that enter the activity but are not used for lifting; nor to other machines not used to lift loads suspended by rigging equipment. However, LHE accidents occurring during such operations must be reported.

- a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE

entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Contractor's operator must remain with the crane during the spot check. Rigging gear must be in accordance with OSHA, ASME B30.9 Standards safety standards.

- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.
- e. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11, and ASME B30.5 or ASME B30.22 as applicable.
- f. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.
- g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- h. All employees must keep clear of loads about to be lifted and of suspended loads, except for employees required to handle the load.
- i. Use cribbing when performing lifts on outriggers.
- j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- k. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.
- l. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.
- m. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.
- n. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

- o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.
- q. Follow FAA guidelines when required based on project location.

### 3.7.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment must be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

### 3.7.4 Base Mounted Drum Hoists

- a. Operation of base mounted drum hoists must be in accordance with EM 385-1-1 and ASSP A10.22.
- b. Rigging gear must be in accordance with applicable ASME/OSHA standards.
- c. When used on telecommunication towers, base mounted drum hoists must be in accordance with TIA-1019, TIA-222, ASME B30.7, 29 CFR 1926.552, and 29 CFR 1926.553.
- d. When used to hoist personnel, the AHA must include a written standard operating procedure. Operators must have a physical examination in accordance with EM 385-1-1 Section 16.B.05 and trained, at a minimum, in accordance with EM 385-1-1 Section 16.U and 16.T. The base mounted drum hoist must also comply with OSHA Instruction CPL 02-01-056 and ASME B30.23.
- e. Material and personnel must not be hoisted simultaneously.
- f. Personnel cage must be marked with the capacity (in number of persons) and load limit in pounds.
- g. Construction equipment must not be used for hoisting material or personnel or with trolley/tag lines. Construction equipment may be used for towing and assisting with anchoring guy lines.

### 3.7.5 Use of Explosives

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must

be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

### 3.8 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

#### 3.8.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

#### 3.8.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within 3 feet of the underground system.

#### 3.8.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever Contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

### 3.9 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Sections 11 and 12.

#### 3.9.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space



during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

### 3.9.2 Qualifications

Electrical work must be performed by QP with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

### 3.9.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

### 3.9.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

### 3.9.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

SECTION 01 41 50

SEISMIC CONTROL REQUIREMENTS

07/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

1.2 DESIGN REQUIREMENTS

1.2.1 Seismic Design

Design, select, construct, and install work and equipment to resist seismic forces as required by ICC IBC, as modified by UFC 3-301-01 and as established by the HDR AE. Seismic Design for:

- a. Occupancy Category III, Seismic Design Category C.
- b. Site Class D,  $S_s = 0.161$  g,  $S_1 = 0.043$  g.
- c. IE equals 1.25

1.2.2 Direct Supervision

Design seismic restraint system under direct supervision of an experienced Professional Engineer licensed in at least one State in the United States of America.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 41 60

WIND LOAD DESIGN CRITERIA  
07/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2019, with Change 1, 2022) Structural Engineering

1.2 DESIGN CRITERIA

1.2.1 Systems

Design systems to withstand wind loads in accordance with ICC IBC, as modified by UFC 3-301-01 and as established by the HDR AE. Deflection limits, if any, are shown in the related technical specification Sections for the systems involved.

1.2.2 Wind Loads

- a. Basic Wind Speed ( 3 second gust ) equals 90 mph (144 kmph).
- b. Importance Factor  $lw = 1.15$
- c. Building Category: I
- d. Exposure Category C
- e. Design of components and cladding shall be per ICC IBC

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

02/19

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AACE INTERNATIONAL (AACE)  
1265 Suncrest Towne Centre Drive  
Morgantown, WV 26505-1876 USA  
Ph: 304-296-8444  
Fax: 304-291-5728  
Internet: <https://web.aacei.org/>

ACOUSTICAL SOCIETY OF AMERICA (ASA)  
1305 Walt Whitman Road, Suite 300  
Melville, NY 11747-4300  
Ph: 516-576-2360  
Fax: 631-923-2875  
E-mail: [asa@acousticalsociety.org](mailto:asa@acousticalsociety.org)  
Internet: <https://acousticalsociety.org/>

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)  
444 North Capital Street, NW, Suite 249  
Washington, DC 20001  
Ph: 202-624-5800  
Fax: 202-624-5806  
E-Mail: [info@ashto.org](mailto:info@ashto.org)  
Internet: <https://www.transportation.org/>

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
1899 L Street, NW, 11th Floor  
Washington, DC 20036  
Ph: 202-293-8020  
Fax: 202-293-9287  
E-mail: [storemanager@ansi.org](mailto:storemanager@ansi.org)  
Internet: <https://www.ansi.org/>

Repair Steam Sterilization Plant (SSP)

AMERICAN PETROLEUM INSTITUTE (API)  
1220 L Street, NW  
Washington, DC 20005-4070  
Ph: 202-682-8000  
Internet: <https://www.api.org/>

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)  
P.O. Box 28518  
1711 Arlingate Lane  
Columbus, OH 43228-0518  
Ph: 800-222-2768 or 614-274-6003  
Fax: 614-274-6899  
E-mail: [tjones@asnt.org](mailto:tjones@asnt.org)  
Internet: <https://www.asnt.org/>

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)  
1791 Tullie Circle, NE  
Atlanta, GA 30329  
Ph: 404-636-8400 or 800-527-4723  
Fax: 404-321-5478  
E-mail: [ashrae@ashrae.org](mailto:ashrae@ashrae.org)  
Internet: <https://www.ashrae.org/>

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)  
Two Park Avenue  
New York, NY 10016-5990  
Ph: 800-843-2763  
Fax: 973-882-1717  
E-mail: [customercare@asme.org](mailto:customercare@asme.org)  
Internet: <https://www.asme.org/>

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)  
520 N. Northwest Highway  
Park Ridge, IL 60068  
Ph: 847-699-2929  
E-mail: [customerservice@assp.org](mailto:customerservice@assp.org)  
Internet: <https://www.assp.org/>

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)  
18927 Hickory Creek Drive, Suite 220  
Mokena, IL 60448  
Ph: 708-995-3019  
Fax: 708-479-6139  
Internet: <http://www.asse-plumbing.org>

AMERICAN WATER WORKS ASSOCIATION (AWWA)  
6666 W. Quincy Avenue  
Denver, CO 80235 USA  
Ph: 303-794-7711 or 800-926-7337  
Fax: 303-347-0804  
Internet: <https://www.awwa.org/>

AMERICAN WELDING SOCIETY (AWS)  
8669 NW 36 Street, #130  
Miami, FL 33166-6672  
Ph: 800-443-9353  
Internet: <https://www.aws.org/>

Repair Steam Sterilization Plant (SSP)

ASSOCIATED AIR BALANCE COUNCIL (AABC)  
1220 19th St NW, Suite 410  
Washington, DC 20036  
Ph: 202-737-0202  
Fax: 202-315-0285  
E-mail: [info@aabc.com](mailto:info@aabc.com)  
Internet: <https://www.aabc.com/>

ASTM INTERNATIONAL (ASTM)  
100 Barr Harbor Drive, P.O. Box C700  
West Conshohocken, PA 19428-2959  
Ph: 610-832-9500  
Fax: 610-832-9555  
E-mail: [service@astm.org](mailto:service@astm.org)  
Internet: <https://www.astm.org/>

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)  
355 Lexington Avenue, 15th Floor  
New York, NY 10017  
Ph: 212-297-2122  
Fax: 212-370-9047  
Internet: <https://www.buildershardware.com/>

CAST IRON SOIL PIPE INSTITUTE (CISPI)  
2401 Fieldcrest Drive  
Mundelein, IL 60060  
Ph: 224-864-2910  
Internet: <https://www.cispi.org/>

COMPRESSED GAS ASSOCIATION (CGA)  
14501 George Carter Way, Suite 103  
Chantilly, VA 20151-1788  
Ph: 703-788-2700  
Fax: 703-961-1831  
E-mail: [cga@cganet.com](mailto:cga@cganet.com)  
Internet: <https://www.cganet.com/>

COPPER DEVELOPMENT ASSOCIATION (CDA)  
Internet: <https://www.copper.org/>

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)  
722 Jackson Place  
Washington DC 20506  
Internet: <https://www.whitehouse.gov/administration/eop/ceq>

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)  
310 Maxwell Road, Suite 200  
Alpharetta, GA 30009  
Ph: 678-393-9990  
Fax: 678-393-9998  
E-mail: [emikoski@ecianow.org](mailto:emikoski@ecianow.org)  
Internet: <https://www.ecianow.org>

FM GLOBAL (FM)  
270 Central Avenue  
Johnston, RI 02919-4949  
Ph: 401-275-3000  
Fax: 401-275-3029

Repair Steam Sterilization Plant (SSP)

Internet: <https://www.fmglobal.com/>

HYDRAULIC INSTITUTE (HI)  
6 Campus Drive, First Floor North  
Parsippany, NJ 07054-4405  
Ph: 973-267-9700  
Fax: 973-267-9055  
Internet: <http://www.pumps.org>

ILLUMINATING ENGINEERING SOCIETY (IES)  
120 Wall Street, Floor 17  
New York, NY 10005-4001  
Ph: 212-248-5000  
Fax: 212-248-5018  
E-mail: [membership@ies.org](mailto:membership@ies.org)  
Internet: <https://www.ies.org/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)  
445 and 501 Hoes Lane  
Piscataway, NJ 08854-4141  
Ph: 732-981-0060 or 800-701-4333  
Fax: 732-981-9667  
E-mail: [onlinesupport@ieee.org](mailto:onlinesupport@ieee.org)  
Internet: <https://www.ieee.org/>

INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY (IEST)  
1827 Walden Office Square, Suite 400  
Schaumburg, IL 60173  
Ph: 847-981-0100  
Fax: 847-981-4130  
E-mail: [information@iest.org](mailto:information@iest.org)  
Internet: <https://www.iest.org/>

INTERNATIONAL CODE COUNCIL (ICC)  
500 New Jersey Avenue, NW  
6th Floor, Washington, DC 20001  
Ph: 800-786-4452 or 888-422-7233  
Fax: 202-783-2348  
E-mail: [order@iccsafe.org](mailto:order@iccsafe.org)  
Internet: <https://www.iccsafe.org/>

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)  
1000 Westgate Drive, Suite 252  
St. Paul, MN 55114  
Ph: 651-366-6095  
Fax: 651-290-2266  
E-mail: [info@icri.org](mailto:info@icri.org)  
Internet: <https://www.icri.org/>

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)  
3050 Old Centre Ave. Suite 101  
Portage, MI 49024  
Ph: 269-488-6382  
Fax: 269-488-6383  
Internet: <https://www.netaworld.org/>

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)  
3, rue de Varembe, 1st floor  
P.O. Box 131

Repair Steam Sterilization Plant (SSP)

CH-1211 Geneva 20, Switzerland  
Ph: 41-22-919-02-11  
Fax: 41-22-919-03-00  
E-mail: [info@iec.ch](mailto:info@iec.ch)  
Internet: <https://www.iec.ch/>

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)  
ISO Central Secretariat  
BIBC II  
Chemin de Blandonnet 8  
CP 401 - 1214 Vernier, Geneva  
Switzerland  
Ph: 41-22-749-01-11  
E-mail: [central@iso.ch](mailto:central@iso.ch)  
Internet: <https://www.iso.org>

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)  
127 Park Street, NE  
Vienna, VA 22180-4602  
Ph: 703-281-6613  
E-mail: [info@msshq.org](mailto:info@msshq.org)  
Internet: <http://msshq.org>

NACE INTERNATIONAL (NACE)  
15835 Park Ten Place  
Houston, TX 77084  
Ph: 281-228-6200  
Fax: 281-228-6300  
E-mail: [firstservice@nace.org](mailto:firstservice@nace.org)  
Internet: <https://www.nace.org>

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)  
800 Roosevelt Road, Bldg C, Suite 312  
Glen Ellyn, IL 60137  
Ph: 630-942-6591  
Fax: 630-790-3095  
E-mail: [info@naamm.org](mailto:info@naamm.org)  
Internet: <http://www.naamm.org>

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)  
1300 North 17th Street, Suite 900  
Arlington, VA 22209  
Ph: 703-841-3200  
Internet: <https://www.nema.org>

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)  
8575 Grovemont Circle  
Gaithersburg, MD 20877  
Ph: 301-977-3698  
Fax: 301-977-9589  
Internet: <http://www.nebb.org>

NATIONAL FENESTRATION RATING COUNCIL (NFRC)  
6305 Ivy Lane, Suite 140  
Greenbelt, MD 20770  
Ph: 301-589-1776  
Fax: 301-589-3884  
E-Mail: [info@nfrc.org](mailto:info@nfrc.org)



Repair Steam Sterilization Plant (SSP)

Internet: <http://www.nfrc.org>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1 Batterymarch Park  
Quincy, MA 02169-7471

Ph: 800-344-3555

Fax: 800-593-6372

Internet: <https://www.nfpa.org>

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES  
(NICET)

1420 King Street

Alexandria, VA 22314-2794

Ph: 888-476-4238 (1-888 IS-NICET)

E-mail: [tech@nicet.org](mailto:tech@nicet.org)

Internet: <https://www.nicet.org/>

NATIONAL INSTITUTE OF BUILDING SCIENCES (NIBS)

1090 Vermont Avenue NW, Suite 700

Washington, DC 20005

Ph: 202-289-7800

Fax: 202-289-1092

Internet: <http://www.wbdg.org>

NSF INTERNATIONAL (NSF)

789 North Dixboro Road

P.O. Box 130140

Ann Arbor, MI 48105

Ph: 734-769-8010 or 800-NSF-MARK

Fax: 734-769-0109

E-mail: [info@nsf.org](mailto:info@nsf.org)

Internet: <http://www.nsf.org>

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

800 Roosevelt Road

Building C, Suite 312

Glen Ellyn, IL 60137

Ph: 630-858-6540

Fax: 630-790-3095

Internet: <https://www.ppfahome.org/>

PLUMBING AND DRAINAGE INSTITUTE (PDI)

800 Turnpike Street, Suite 300

North Andover, MA 01845

Ph: 978-557-0720 or 800-589-8956

E-Mail: [pdipdi@pdionline.org](mailto:pdipdi@pdionline.org)

Internet: <http://www.pdionline.org>

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

200 West Adams St., 2100

Chicago, IL 60606

Ph: 312-786-0300

Bookstore: 312-428-4946

Internet: <https://www.pci.org/>

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

4201 Lafayette Center Drive

Repair Steam Sterilization Plant (SSP)

Chantilly, VA 20151-1219  
Ph: 703-803-2980  
Fax: 703-803-3732  
Internet: <https://www.smacna.org/>

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)  
400 Commonwealth Drive  
Warrendale, PA 15096  
Ph: 877-606-7323 or 724-776-4841  
Fax: 724-776-0790  
E-mail: [customerservice@sae.org](mailto:customerservice@sae.org)  
Internet: <https://www.sae.org/>

STEEL DOOR INSTITUTE (SDI/DOOR)  
30200 Detroit Road  
Westlake, OH 44145  
Ph: 440-899-0010  
Fax: 440-892-1404  
E-mail: [info@steeldoors.org](mailto:info@steeldoors.org)  
Internet: <https://www.steeldoors.org/>

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)  
1320 North Courthouse Road, Suite 200  
Arlington, VA 22201  
Ph: 703-907-7700  
Fax: 703-907-7727  
E-mail: [marketing@tiaonline.org](mailto:marketing@tiaonline.org)  
Internet: <https://www.tiaonline.org/>

U.S. ARMY CORPS OF ENGINEERS (USACE)  
CRD-C DOCUMENTS available on Internet:  
<http://www.wbdg.org/ffc/army-coe/standards>  
Order Other Documents from:  
Official Publications of the Headquarters, USACE  
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Internet: <http://www.publications.usace.army.mil/>  
or  
<https://www.hnc.usace.army.mil/Missions/Engineering-Directorate/TECHINFO/>

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E-mail: [PA@ams.usda.gov](mailto:PA@ams.usda.gov)  
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STOP 1510, Rm 5135  
1400 Independence Avenue SW  
Washington, DC 20250-1510  
Phone: (202) 720-9540  
Internet:  
<https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service>

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U.S. DEPARTMENT OF DEFENSE (DOD)  
Order DOD Documents from:  
Room 3A750-The Pentagon  
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Washington, DC 20301-1400  
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(ASSIST)  
Department of Defense Single Stock Point (DODSSP)  
Document Automation and Production Service (DAPS)  
Building 4/D  
700 Robbins Avenue  
Philadelphia, PA 19111-5094  
Ph: 215-697-6396 - for account/password issues  
Internet: <https://assist.dla.mil/online/start/>; account  
registration required  
Obtain Unified Facilities Criteria (UFC) from:  
Whole Building Design Guide (WBDG)  
National Institute of Building Sciences (NIBS)  
1090 Vermont Avenue NW, Suite 700  
Washington, DC 20005  
Ph: 202-289-7800  
Fax: 202-289-1092  
Internet:  
<https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc>

U.S. DEPARTMENT OF ENERGY (DOE)  
1000 Independence Avenue Southwest  
Washington, D.C. 20585  
Ph: 202-586-5000  
Fax: 202-586-4403  
E-mail: [The.Secretary@hq.doe.gov](mailto:The.Secretary@hq.doe.gov)  
Internet: <https://www.energy.gov/>

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)  
1200 Pennsylvania Avenue, N.W.  
Washington, DC 20004  
Ph: 202-564-4700  
Internet: <https://www.epa.gov>  
--- Some EPA documents are available only from:  
National Technical Information Service (NTIS)  
5301 Shawnee Road  
Alexandria, VA 22312  
Ph: 703-605-6060 or 1-800-363-2068  
Fax: 703-605-6880  
TDD: 703-487-4639  
E-mail: [info@ntis.gov](mailto:info@ntis.gov)  
Internet: <https://www.ntis.gov/>

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)  
445 12th Street SW  
Washington, DC 20554  
Ph: 888-225-5322  
TTY: 888-835-5322

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Bookstore: 202-512-0132  
Internet: <https://www.gpo.gov/>

UNDERWRITERS LABORATORIES (UL)  
2600 N.W. Lake Road  
Camas, WA 98607-8542  
Ph: 877-854-3577 or 360-817-5500  
E-mail: [CustomerExperienceCenter@ul.com](mailto:CustomerExperienceCenter@ul.com)  
Internet: <https://www.ul.com/>  
UL Directories available through IHS at <https://ihsmarkit.com/>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00.00 10

QUALITY CONTROL  
11/16, CHG 2: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3740 (2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E329 (2021) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-12 (2006; Change 1) Engineering and Design -- Quality Management

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable Pricing Schedule item.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G

Additional Requirements for Design Quality Control (DQC) Plan; G, DO

SD-05 Design Data

Discipline-Specific Checklists

Design Quality Control

SD-06 Test Reports

## Verification Statement

### 1.4 MOCK-UPS

- a. Schedule mock-up of items for review and comment by Contracting Officer sufficiently in advance of scheduled fabrication and/or installation to allow for corrections and/or modifications with no effect on construction schedule.
- b. Tests, if specified, will be performed under provisions of the respective Product Specification Sections.
- c. Except where approved mock-ups are permitted to remain as part of the work (in place), erect mock-ups in a remote area that will not interfere with construction until start of site work.
- d. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes. Fabricated items which include the work of other sections, such as, but not limited to, mechanical plumbing and electrical fixtures, EDS equipment fittings and accessories shall have those items properly placed without service connections.
- e. Mockup for equipment to be fully functional with final quality of workmanship and connections.
- f. Approved mock-ups shall represent quality level required for remaining work. Protect approved mock-ups from damage.
- g. Remove mock-ups not specified to remain part of the work. Do not remove mock-ups until directed to do so by the Contracting Officer.
- h. Submit each request for Mock-Up Observation on the "Request for Mock-Up Observation" Form. See sample copy at end of this Section.
- i. After mock-up observation, record observations on the "Mock-Up Observation" form. See sample at end of this Section.
- j. See Section 22 72 00.01 EFFLUENT DECONTAMINATION SYSTEM for specific EDS equipment mock-up requirements.
- k. EDS Equipment mockup to be reviewed and approved by USACE, commissioning agents, prior to final acceptance to proceed with remainder of work.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed

to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

### 3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 15 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. The Government will consider an interim plan for the first 30 days of operation. Design and construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

#### 3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all design and construction-operations, both onsite and offsite, including work by subcontractors designers of record, consultants, architect/engineers (AE), fabricators, suppliers and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to an individual other than the project superintendent. The individual should be outside of the project superintendent's chain of command and must be shown as at least one level above the project superintendent in the chain of command.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph

requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer are required to be used.)

- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.
- j. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections. Where the applicable code issued by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the QC Plan.

### 3.2.2 Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

- a. Submit and maintain a Design Quality Control (DQC) Plan as an effective quality control program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.
- b. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change



within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists. ER 1110-1-12 provides some useful information in developing checklists.

- c. Implement the DQC Plan by a Design Quality Control Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Contracting Officer, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

The Contracting Officer will notify the Contractor in writing of the acceptance of the DQC Plan. After acceptance, any changes proposed by the Contractor are subject to the acceptance of the Contracting Officer.

### 3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the Contractor Quality Control (CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.4 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 3.3 COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 15 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

## 3.4 QUALITY CONTROL ORGANIZATION

### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager, and sufficient number of

additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible for maintaining these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC System Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 5 years construction experience on construction similar to this Contract or a construction person with a minimum of 10 years in related work. This CQC System Manager is on the site at all times during construction and is employed by the prime Contractor. The CQC System Manager is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

#### 3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, plumbing, architectural, Cx Agent. These individuals or specialized technical companies are directly employed by the prime Contractor and can not be employed by a supplier or subcontractor on this project ; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel's areas of responsibility; have the necessary education or experience in accordance with the experience matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality control duties as described in the Quality Control Plan. A single person can cover more than one area provided that the single person is qualified to perform quality control activities in each designated and that workload allows.

## Repair Steam Sterilization Plant (SSP)

Experience Matrix	
Area	Qualifications
Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 years of experience supervising mechanical features of work in the field with a construction company
Plumbing	Graduate Mechanical Engineer with 2 yrs experience or person with 5 years of experience supervising mechanical features of work in the field with a construction company
Electrical	Graduate Electrical Engineer with 2 years related experience or person 5 years of experience supervising electrical features of work in the field with a construction company
Architectural	Graduate Architect with 2 years experience or person with 5 years related experience
Cx Agent	Graduate Architect or Engineer with 2 years' experience

### 3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors" within 45 calendar days after NTP is a mandatory requirement for the position of the Quality Control Systems Manager. Certification is good for five (5) years at which time re-training is required. The Contractor's QC Systems Manager may be appointed and serve fully in that capacity pending certification. If the CQC Systems Manager fails to successfully complete the training, the Contractor should promptly appoint a new CQSM who shall then attend the next available course. The course is nine (9) hours long (1 day). The Construction Quality Management Course (CQMC) will be taught at least nine (9) times per year by the Baltimore District Corps of Engineers, at various locations around Baltimore and Washington, D.C., or at another site if conditions warrant. The CQMC cost will be borne by the Contractor and is approximately two hundred ten dollars (\$210.00) per course, per person (check with ABC and GCA for current price). Payment shall be made by check payable to either sponsors of the course; Associated Builders and Contractors, Inc., (ABC) 14120 Park Long Court, Suite 111, Chantilly, Virginia 20151 (Phone: 703-968-6205), or to the Associated General Contractors of America (GCA), Maryland Chapter, 1301 York Road, Heaver Plaza, Suite 202, Lutherville, Maryland 21093 (Phone: 410-321-7870) prior to the start of the course. Reservations to attend the course should be made directly to the organization sponsoring the course they attend. The

Contractor has forty-five (45) calendar days to attend the course after the issuance of the NTP. The Contractor shall contact the Contracting Officer upon award of the contract arrangements for the course.

#### 3.4.5 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

#### 3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING are included in the contract, the submittals required by those sections have to be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

##### 3.5.1 In-place Mock-ups

In-place quality control mock-ups specified below, to remain part of the work if approved, shall be approved by the Contracting Officer before continuing with the work in other areas. Final locations for in-place mock-ups will be as selected and approved by the Contracting Officer prior to starting in-place work.

###### 3.5.1.1 In-place Fluid Applied Flooring

As specified in Section 09 67 00 FLUID-APPLIED FLOORING.

###### 3.5.1.2 In-place Special Coatings

As specified in Section 09 97 00 SPECIAL COATINGS.

#### 3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

##### 3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
- b. Review of the Contract drawings.

- c. Check to assure that all materials and equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.
- f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
- g. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- h. Review of the appropriate activity hazard analysis to assure safety requirements are met.
- i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- k. Discussion of the initial control phase.
- l. The Government needs to be notified at least 72 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

#### 3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

- a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety

plan and activity hazard analysis. Review the activity analysis with each worker.

- f. The Government needs to be notified at least 72 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.
- g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
- h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

### 3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

### 3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number

system, including all of the test documentation requirements, have been prepared.

- e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

### 3.7.2 Testing Laboratories

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at:

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.

#### 3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

## 3.8 RISK ASSESSMENT

The vendor shall establish an approved agenda, and conduct a detailed risk analysis for the EDS system during the DB design phase. The Risk Analysis shall review multiple aspects of the design, and shall gain USACE approval of those aspects listed as fully fulfilling the USACE functional needs. At a minimum, the risk analysis shall: a) gain approval on PFD components and function, b) gain approval on the manner which service of all components occur, and how the isolation of components and lines are provided for to enable those activities, review and gain approval on the EHS (environment, health and safety) / injury to personnel risks, the ergonomics, and full alignment with User protocols. These risks shall include failure types, upset conditions (containment, leak, and similar) and risks to reliability or 'up time' status.

### 3.8.1 Risk Analysis

Risk Analysis shall be performed in two phases, once when the design is at 45% completion, and again more thoroughly when the design is between 60 to 70% completion. Both shall include 3D model reviews for both the EDS skid, and all EDS reliant infrastructure in the room(s) where the EDS components will be installed. Risk assessment should evaluate secondary upset conditions, and safety and regulatory/operational compliance based containment consistent with BSL 4 organisms handled by the EDS system.

#### 3.8.1.1 Evaluation of Failures and System Reliability

The evaluation facilitator shall be an individual conversant in the technologies and risks and someone who is not directly involved in the project. The evaluation facilitator shall demonstrate prior experience in successfully performing the following evaluations of failures and system reliability:

##### 3.8.1.1.1 Process Hazard Analysis (PHA)

Review of the schematic design or Process Flow Diagram (PFD); identify and delineate major "What if" scenarios to established redundancies of skids, equipment, and support utilities. Example of such a scenario: what happens if the air compressors fails, what is the impact to the EDS and how does it affect the design. Submit a detailed written report of possible scenarios at the 30% - 45% completion level of the project. Use the current PFD for this exercise.

##### 3.8.1.1.2 Hazard Operations Analysis (HazOp)

Review of safety and hazard scenarios and identify and delineate possible major hazardous events. Example of such a scenario: does the EDS system address the requirement of providing a safety relief valve due to thermal expansion, or is the containment of a potential leak from the EDS adequately addressed; does the owner require separate panels for 460 volts and 120 volts or can they be separated with in the EDS panel. Submit a detailed written report of review at the 60% - 70% completion level of the project when the PIDs are substantially complete and are at the Issue for HAZOP (IFH) level.

##### 3.8.1.1.3 Failure Mode Effect Analysis (FMEA)

Review of the Issue for Design (IFD) PID's at the component level for failure and reliability. This analysis shall confirm which component require redundancy based on the failure potential and the reliability of the component. This effort shall also determine what spares should be readily available based on how critical and reliable the component is. Submit a detailed written report of review at 60% - 70% completion level of the project.

### 3.9 COMPLETION INSPECTION

#### 3.9.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in FAR 52.211-10 Commencement, Prosecution, and Completion of Work, or by the specifications. Prepare and include in the CQC documentation a punch list



of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

### 3.9.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

### 3.9.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative is required to be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands can also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance FAR 52.246-12 Inspection of Construction.

## 3.10 DOCUMENTATION

### 3.10.1 Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

- a. The name and area of responsibility of the Contractor/Subcontractor.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and control activities performed with results and references to

specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and specifications.
- j. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Review (ITR) team, the ITR review comments, responses and the record of resolution of the comments.

### 3.10.2 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily within 72 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control (CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

### 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the

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Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

Attachment:

Sample forms "Request for Mock-Up Observation" and "Mock-Up Observation"

-- End of Section --

DRAFT

## MOCK-UP OBSERVATION REQUEST

Request No. \_\_\_\_\_

Date: \_\_\_\_\_

---

Project: \_\_\_\_\_

Contract For: \_\_\_\_\_

A/E Project Number: \_\_\_\_\_

Client Project Number: \_\_\_\_\_

---

Specification Title: \_\_\_\_\_

Section: \_\_\_\_\_

Page/Article Describing Mock-Up: \_\_\_\_\_

---

Date For Mock-Up Observation: \_\_\_\_\_

Mock-Up Description:

\_\_\_\_\_

Location: (If other than Project Site, give full name and address):

Project Site: ☐ (State Location):

Off Site ☐ (State Location): \_\_\_\_\_

# MOCK-UP OBSERVATION REPORT

Report No. \_\_\_\_\_

Date: \_\_\_\_\_

Project: \_\_\_\_\_

Contract For: \_\_\_\_\_

A/E Project Number: \_\_\_\_\_

Client Project Number: \_\_\_\_\_

Specification Title: \_\_\_\_\_

Section: \_\_\_\_\_

Page/Article Describing Mock-Up: \_\_\_\_\_

Date For Mock-Up Observation: \_\_\_\_\_

Mock-Up Description: \_\_\_\_\_

Location: (If other than Project Site, give full name and address): \_\_\_\_\_

Project Site: ☐ (State Location): \_\_\_\_\_

Off Site ☐ (State Location): \_\_\_\_\_

Attendee for Client: \_\_\_\_\_ Attendee for A/E: \_\_\_\_\_

Attendee for [Contractor] [CM]: \_\_\_\_\_

Attendee for Manufacturer: \_\_\_\_\_

Additional Attendees: (Name, Title, Affiliation): \_\_\_\_\_

Person Writing This Report: \_\_\_\_\_

Representing: \_\_\_\_\_

Comments: \_\_\_\_\_

Mock Up Accepted: Yes ☐ No ☐ Explain: \_\_\_\_\_

Action to Be Taken: \_\_\_\_\_

Additional comments:

☐ [Contractor] [CM] ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ Other ☐

SECTION 01 45 00.15 10

RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)

11/16, CHG 2: 08/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

(2014) Safety -- Safety and Health Requirements Manual

1.2 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

Administration  
Finances  
Quality Control  
Submittal Monitoring  
Scheduling  
Closeout  
Import/Export of Data

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some correspondence, including pay requests and payrolls, are also to be provided in paper format with original signatures. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the reporting accomplished through RMS. Particular attention is directed to FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt

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Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; Section 01 32 01.00 10 PROJECT SCHEDULE; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00.00 10 QUALITY CONTROL.

### 1.4 RMS SOFTWARE

RMS is a web based application. Download, install and be able to utilize the latest version of RMS within 7 calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (<https://rms.usace.army.mil>). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

### 1.5 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance(QA)comments, as well as other miscellaneous administrative information.

### 1.6 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

#### 1.6.1 Administration

##### 1.6.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 calendar days of receiving access to the contract in RMS. This includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

##### 1.6.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within 7 calendar days of receiving access to the contract in RMS or within 7 calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

##### 1.6.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office

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with "H". Letters are numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C" or "RFP".

### 1.6.1.4 Equipment

Enter and maintain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

### 1.6.1.5 Reports

Track the status of the project utilizing the reports available in RMS. The value of these reports is reflective of the quality of the data input. These reports include the Progress Payment Request worksheet, Quality Control (QC) comments, Submittal Register Status, and Three-Phase Control worksheets.

### 1.6.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

## 1.6.2 Finances

### 1.6.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project schedule. The sum of pay activities equals the total contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities assigned to a CLIN equals the amount of each CLIN.

### 1.6.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work completed under the contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data either electronically or by hard copy. Unless waived by the Contracting Officer, a signed paper copy of the approved payment certification and request is also required and will govern in the event of discrepancy with the electronic version.

## 1.6.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC Control System, QC testing, transferred and installed property and warranties in RMS. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Insure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments of same within 7 calendar days of Government acceptance of the CQC Plan.

### 1.6.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (QC) Daily Report in RMS is the official



report. The Contractor can use other supplemental formats to record QC data, but information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

#### 1.6.3.2 Deficiency Tracking.

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

#### 1.6.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS. Worksheets for the three-phase control meetings are generated within RMS.

#### 1.6.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

#### 1.6.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

#### 1.6.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

#### 1.6.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

#### 1.6.4 Submittal Management

Enter all current submittal register data and information into RMS within 7 calendar days of receiving access to the contract in RMS. The information shown on the submittal register following the specification Section 01 33 00 SUBMITTAL PROCEDURES will already be entered into the RMS database when access is granted. Group electronic submittal documents into transmittal packages to send to the Government, except very large

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electronic files, samples, spare parts, mock ups, color boards, or where hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

### 1.6.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in Section 01 32 01.00 10 PROJECT SCHEDULE.

### 1.6.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

## 1.7 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

## 1.8 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within 7 calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 45 35

SPECIAL INSPECTIONS

11/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

1.2 GENERAL REQUIREMENTS

Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the Prime Contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

1.3 DEFINITIONS

1.3.1 Continuous Special Inspections

Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

1.3.2 Perform

Perform these Special Inspections tasks for each welded joint or member.

1.3.3 Observe

Observe these Special Inspections items on a periodic daily basis. Operations need not be delayed pending these inspections.

1.3.4 Special Inspector (SI)

A qualified person retained by the Contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

1.3.5 Associate Special Inspector (ASI)

A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and

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cannot perform inspections without the SI on site.

### 1.3.6 Third Party

A Special inspector must not be an employee of the Contractor or of any Sub-Contractor performing the work to be inspected.

### 1.3.7 Contracting Officer

The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

### 1.3.8 Contractor's Quality Control (QC) Manager

An individual retained by the Prime Contractor and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL having the overall responsibility for the Contractor's QC organization.

### 1.3.9 Structural Engineer of Record (SER)

A registered design professional retained by the Prime Contractor responsible for the overall design and review of submittal documents prepared by others. The SER is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in the state in which the design professional works. The SER is also referred to as the Engineer of Record (EOR) in design code documents.

### 1.3.10 Statement of Special Inspections (SSI)

A document developed by the SER identifying the material, systems, components and work required to have Special Inspections. This statement is included at the end of this specification.

### 1.3.11 Schedule of Special Inspections (SSI)

A schedule which lists each of the required Special Inspections, the extent to which each Special Inspection is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17.

### 1.3.12 Definable Feature of Work (DFOW)

An inspection group that is separate and distinct from other inspection groups, having inspection requirements or inspectors that are unique.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Special Inspections Project Manual; G

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Special Inspections Agency's Written NDT Practices with method and evidence of regular equipment calibration where applicable

SD-06 Test Reports

Special Inspections Daily Reports

Special Inspections Biweekly Reports

SD-07 Certificates

Piping/Component System Weld Inspection/Criteria Requirements; G

Certificate of Compliance

Special Inspector Qualifications; G

Qualification Records for NDT technicians

SD-11 Closeout Submittals

Comprehensive Final Report of Special Inspections; G

1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each special inspector.

1.5.1 Steel Construction and High Strength Bolting

1.5.1.1 Special Inspector

- a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
- b. Registered Professional Engineer with three years of related experience

1.5.1.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.2 Welding Structural Steel

1.5.2.1 Special Inspector

- a. ICC Structural Welding Special Inspector certificate with one year of related experience, or
- b. AWS Certified Welding Inspector

1.5.2.2 Associate Special Inspector

AWS Certified Associate Welding Inspector

1.5.3 Nondestructive Testing of Welds

1.5.3.1 Special Inspector

NDT Level III Certificate

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1.5.3.2 Associate Special Inspector

NDT Level II Certificate plus one year of related experience

1.5.4 Cold Formed Steel Framing

1.5.4.1 Special Inspector

- a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
- b. ICC Commercial Building Inspector with one year of experience, or
- c. ICC Residential Building Inspector with one year of experience, or
- d. Registered Professional Engineer with three years related experience

1.5.4.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.5 Concrete Construction

1.5.5.1 Special Inspector

- a. ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or
- b. ACI Concrete Construction Special Inspector, or
- c. Registered Professional Engineer with three years of related experience

1.5.5.2 Associate Special Inspector

- a. ACI Concrete Construction Special Inspector in Training, or
- b. Engineer-In-Training with one year of related experience

1.5.6 Prestressed Concrete Construction

1.5.6.1 Special Inspector

- a. ICC Pre-stressed Special Inspector Certificate with one year of related experience, or
- b. PCI Quality Control Technician/ Inspector Level II Certificate with one year of related experience, or
- c. Registered Professional Engineer with three years of related experience

1.5.6.2 Associate Special Inspector

- a. PCI Quality Control Technician/ Inspector Level I Certificate with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

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1.5.7 Post-tensioned Concrete Construction

1.5.7.1 Special Inspector

- a. PTI Level 2 Unbonded PT Inspector Certificate, or
- b. Registered Professional Engineer with three years of related experience

1.5.7.2 Associate Special Inspector

- a. PTI Level 1 Unbonded PT Inspector Certificate with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

1.5.8 Masonry Construction

1.5.8.1 Special Inspector

- a. ICC Structural Masonry Special Inspector Certificate with one year of related experience, or
- b. Registered Professional Engineer with three years of related experience

1.5.8.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.9 Wood

1.5.9.1 Special Inspector

- a. ICC Commercial Building Inspector Certificate with one year of related experience, or
- b. ICC Residential Building Inspector with one year of experience, or
- c. Registered Professional Engineer with three years of related experience

1.5.9.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.10 Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements

1.5.10.1 Special Inspector

- a. ICC Soils Special Inspector Certificate with one year of related experience, or
- b. NICET Soils Technician Level II Certificate in Construction Material Testing, or
- c. Geologist-In-Training with three years of related experience, or
- d. Registered Professional Engineer with three years of related experience

Repair Steam Sterilization Plant (SSP)

1.5.10.2 Associate Special Inspector

- a. NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
- b. Engineer-In-Training with one year of related experience

1.5.11 Deep Foundations

1.5.11.1 Special Inspector

- a. NICET Soils Technician Level II Certificate in Construction Material Testing, or
- b. Geologist-In-Training with three years of related experience, or
- c. Registered Professional Engineer with three years of related experience

1.5.11.2 Associate Special Inspector

- a. NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
- b. NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or
- c. Engineer-In-Training with one year of related experience

1.5.12 Sprayed Fire Resistant Material

1.5.12.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or
- c. Registered Professional Engineer or Architect with related experience

1.5.12.2 Associate Special Inspector

Engineer-In-Training with one year of related experience

1.5.13 Mastic and Intumescent Fire Resistant Coatings

1.5.13.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or
- c. Registered Professional Engineer or Architect with related experience

1.5.13.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.



## Repair Steam Sterilization Plant (SSP)

### 1.5.14 Exterior Insulation and Finish System (EIFS)

#### 1.5.14.1 Special Inspector

- a. AWCI EIFS Inspector Certificate, or
- b. Exterior Design Institute Certificate, or
- c. Registered Professional Engineer or Architect with related experience

#### 1.5.14.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

### 1.5.15 Fire-Resistant Penetrations and Joints

#### 1.5.15.1 Special Inspector

- a. Passed the UL Firestop Exam with one year of related experience, or
- b. Passed the FM Firestop Exam with one year of related experience, or
- c. Registered Professional Engineer with related experience

#### 1.5.15.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

### 1.5.16 Smoke Control

#### 1.5.16.1 Special Inspector

- a. AABC Technician Certification with one year of related experience, or
- b. Registered Professional Engineer with related experience

#### 1.5.16.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

## PART 2 PRODUCTS

### 2.1 FABRICATOR SPECIAL INSPECTIONS

Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the following certification to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

#### 2.1.1 Piping/Component System Weld Inspection/Criteria Requirements

- a. Welding Inspection as specified in Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS, Section 22 72 00.01 EFFLUENT DECONTAMINATION SYSTEM, and Section 40 17 26.00 WELDING PRESSURE PIPING.

b. Welding Criteria as specified in:

- (1) Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS, Article 3.13 BIOWASTE PIPING WELDING.
- (2) Section 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES, Schedule P-8.17 as applicable to Schedule P-3.12 Service: Biowaste (outside high containment area to SSP, downstream of floor drain trap vent connections).

c. Section 22 72 00.01 EFFLUENT DECONTAMINATION SYSTEM: The EDS and associated piping furnished and installed by EDS manufacturer shall meet pipe installation requirements specified in the Division 22 Plumbing specifications; including but not limited to welds, valves, pipe connections, etc.

2.1.2 Certificate Of Compliance

At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents.

PART 3 EXECUTION

3.1 RESPONSIBILITIES

3.1.1 Quality Control Manager

- a. Supervise all Special Inspectors required by the Contract Documents and the IBC.
- b. Verify the qualifications of all of the Special Inspectors.
- c. Verify the qualifications of fabricators.
- d. Maintain a 3-ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the SER.
- e. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.

3.1.2 Special Inspectors

- a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections.
- b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.
- c. Submit Special Inspections agency's written NDT practices for the monitoring and control of the agency's operations to include the following:
  - (1) The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and

examination requirements for qualifications and certification of inspection personnel.

- (2) The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.
- d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project.
- e. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.
- f. Submit a copy of the daily reports to the QC Manager.
- g. Report discrepancies that are observed during Special Inspections to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.
- h. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:
  - (1) A brief summary of the work performed during the reporting time frame.
  - (2) Changes and discrepancies with the drawings, specifications and mechanical or electrical component certification, that were observed during the reporting period.
  - (3) Discrepancies which were resolved or corrected.
  - (4) A list of nonconforming items requiring resolution.
  - (5) All applicable test result including nondestructive testing reports.
- i. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.

### 3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Contracting Officer to accept such work.

-- End of Section --

Project: P234 - Maintenance Hangar  
 Location: Anytown, VA  
 Project #: 12345678  
 Date: 3/1/2020



## STATEMENT OF SPECIAL INSPECTIONS

Project Seismic Design Category: D  
 Project Risk Category: IV  
 Project Design Wind Speed (mph): 100  
 Number of Stories: 2  
 Structure Height Above Grade (ft): 70  
 Hazardous Occupancy or attached to such? No Group H Occupancies

### **Special Inspector of Record (SIOR)**

A Special Inspector of Record (SIOR) IS required (per UFGS 01 45 35, Section 1.3.8)

SIOR Name (Registered Professional): John Doe P.E.  
 Professional Registration Number: C222222  
 Consulting Firm Name (if any): ABC Structural Consulting  
 SIOR Office AND Mobile Phone Number: 1234567895 (Mobile), 123456789 (Office)

### **Lateral Force Resisting System (LFRS)**

2018 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical main wind/seismic force resisting systems for this structure. Carefully inspect these elements as part of the roles and responsibilities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	Notes
Ordinary Concentric Braced Frames	North - South Direction Only, See Plan
Special Concentric Braced Frames	Lettered Gridline only, see plan for call out
Ordinary Steel Moment resisting Frames (SMRF)	Both orthogonal Directions, See plan for call out
Ordinary Reinforced Concrete Shearwalls	See Key Notes
Concrete Grade Beams Resisting Lateral Loads	Office Portion Only, see plan key notes
Ordinary Reinforced Masonry Shear Walls	High Bay, Numbered Gridlines only, see plan
OSB Sheathed Shear Walls (nailing, sill bolting, Etc)	See schedule on plan
Shear Wall Hold Downs	Identified on Plan & in Detail Sheet X.XX
Horizontal LFRS Elements	Notes
Continuous Roof Ties	See Key Notes on Roof Plan
Collector Elements	Identified on plan with key notes
Concrete over metal deck	2nd floor and roof
Metal Roof Deck & Related Fastening System	See Roof Plan
Out of Plane Wall Connections	See Structural Details XX & XX
Diaphragm Cross Rod Bracing	See Roof Plan for locations
Cast in Place Concrete Floor and Roof Diaphragms	See sheet XX for details and rebar schedule
Special Force Transfer Connection	See Detail X on Sheet X.XX

Project: P234 - Maintenance Hangar  
Location: Anytown, VA  
Project #: 12345678  
Date: 3/1/2020

### Designated Seismic Systems (DSS)

(2018 IBC 1705.13.3) (ASCE 7-16, 13.2.2, C13.2.2) (UFC 3-301-1, 2-5.3)

Non-structural 'Designated Seismic Systems' (DSS) must remain operable and contain hazardous substances following a design earthquake. Accordingly, all Designated Seismic Systems must be listed below and must be certified by the manufacturer to remain both operable and/or to contain hazardous substances after a design earthquake per UFC 3-301-01, Section 3-6.2. Submit said Certificates of Compliance to the Contracting Officer for each DSS after they have been reviewed and accepted by the EOR/DOR.

Additionally, the below listed Designated Seismic Systems must be carefully inspected by the Special Inspector according to the requirements noted in the Schedule of Special Inspections, Section AA.

#### ELECTRICAL Designated Seismic Systems (DSS) Requiring a Certificate of Compliance

1.	DSS Emergency or Standby Power System
2.	DSS Component XX
3.	DSS Component XX
4.	DSS Component XX
5.	DSS Component XX

If additional space is required, append an additional sheet listing the remaining DSS

#### MECHANICAL/PLUMBING Designated Seismic Systems (DSS) Requiring a Certificate of Compliance

1.	DSS Gas lines and associated fittings, anchorage, & flexible Connections
2.	DSS Component XX
3.	DSS Component XX
4.	DSS Component XX
5.	DSS Component XX
6.	DSS Component XX

If additional space is required, append an additional sheet listing the remaining DSS

#### OTHER Designated Seismic Systems (DSS) Requiring a Certificate of Compliance

1.	DSS Building egress stair systems
2.	DSS Building fire sprinkler systems
3.	DSS Component XX
4.	DSS Component XX
5.	DSS Component XX
6.	DSS Component XX

### Final Walk Down Inspection and Report

(UFC 3 301 01 SECTION 2-5.4)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge

Final Walk Down Report, Prepared by the Registered Design Professional in Responsible Charge, Must Include:

1. Record observations of Final Walk Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacture document requirements, and that Compliance Certificates have been collected (UFC 03 301 01, 3-6.2, 13.2.2.2).

## SCHEDULE OF SPECIAL INSPECTIONS

Reference UFGS 01 45 35 for all requirements not noted as part of this schedule.

### INSPECTION DEFINITIONS:

- PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and noted verification.
- OBSERVE:** Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.
- DOCUMENT:** Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.
- CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

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The Seismic Design Category for this project is: ☐ A, ☐ B, ☐ C, ☐ D, ☐ E, ☐ F (check appropriate box)

### DESIGNER NOTES (delete this box after reviewing):

1. This schedule contains minimum requirements. Do not delete applicable inspection tasks unless notes in blue indicate it is acceptable to do so.
2. Blue text = designers notes. The designer must review and edit all blue text in this schedule prior to inserting this schedule into the special inspections spec (UFGS 01 45 35).
3. Check section boxes with ANY inspection tasks applicable to your project. You may choose to delete unchecked sections or leave them in the schedule unchecked.
4. Individual rows/tasks that are not applicable to the project may be left in the section, as the inspector can determine whether they occur/apply (e.g. metal trusses in the light gauge framing section for example).
5. Design discipline sections are color coded for easier reference by designers. This schedule does NOT need to be printed in color.
6. When finished editing, delete this note box and save this schedule as a PDF and insert into the project specifications (special inspections section).

**STRUCTURAL - STEEL – WELDING SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

STEEL INSPECTION <u>PRIOR TO WELDING</u> – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-1		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	<b>PERFORM</b>	
2. Verify manufacturer certifications for welding consumables are available	<b>PERFORM</b>	
3. Verify material identification	<b>PERFORM</b>	Type and grade.
4. Welder Identification System	<b>PERFORM</b>	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	<ul style="list-style-type: none"> <li>✓ Joint preparation</li> <li>✓ Dimensions (alignment, root opening, root face, bevel)</li> <li>✓ Cleanliness (condition of steel surfaces)</li> <li>✓ Tacking (tack weld quality and location)</li> <li>✓ Backing type and fit (if applicable)</li> </ul>
6. Configuration and finish of access holes	OBSERVE	
7. Fit-up of fillet welds	OBSERVE	<ul style="list-style-type: none"> <li>✓ Dimensions (alignment, gaps at root)</li> <li>✓ Cleanliness (condition of steel surfaces)</li> <li>✓ Tacking (tack weld quality and location)</li> </ul>
STEEL INSPECTION <u>DURING WELDING</u> – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Use of qualified welders	<b>PERFORM</b>	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
9. Control and handling of welding consumables	OBSERVE	<ul style="list-style-type: none"> <li>✓ Packaging</li> <li>✓ Electrode atmospheric exposure control</li> </ul>
10. No welding over cracked tack welds	OBSERVE	
11. Environmental conditions	OBSERVE	<ul style="list-style-type: none"> <li>✓ Wind speed within limits</li> <li>✓ Precipitation and temperature</li> </ul>
12. Welding Procedures Specification followed	OBSERVE	<ul style="list-style-type: none"> <li>✓ Settings on welding equipment</li> <li>✓ Travel speed</li> <li>✓ Selected welding materials</li> <li>✓ Shielding gas type/flow rate</li> <li>✓ Preheat applied</li> <li>✓ Interpass temperature maintained (min./max.)</li> <li>✓ Proper position (F, V, H, OH)</li> <li>✓ Intermix of filler metals avoided</li> </ul>
13. Welding techniques	OBSERVE	<ul style="list-style-type: none"> <li>✓ Interpass and final cleaning</li> <li>✓ Each pass within profile limitations</li> <li>✓ Each pass meets quality requirements</li> </ul>

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.

**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)**

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.4-3		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
14. Welds cleaned	OBSERVE	
15. Size, length, and location of all welds	PERFORM	Size, length, and location of all welds conform to the requirements of the detail drawings.
16. Welds meet visual acceptance criteria	PERFORM AND DOCUMENT	<ul style="list-style-type: none"> <li>✓ Crack prohibition</li> <li>✓ Weld/base-metal fusion</li> <li>✓ Crater cross section</li> <li>✓ Weld profiles</li> <li>✓ Weld size</li> <li>✓ Undercut</li> <li>✓ Porosity</li> </ul>
17. Arc strikes	PERFORM	
18. k-area	PERFORM	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
19. Backing removed, weld tabs removed and finished, and fillet welds added where required	PERFORM	
20. Repair activities	PERFORM AND DOCUMENT	
21. Document acceptance or rejection of welded joint or member	PERFORM	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.



**STRUCTURAL - STEEL – BOLTING SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.6-1		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Manufacture's certifications available for fastener materials	<b>PERFORM</b>	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table C-N5.6-2		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
7. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
8. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
9. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
10. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-3		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
11. Document acceptance or rejection of all bolted connections	<b>DOCUMENT</b>	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Section N5.5		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Use of qualified nondestructive testing personnel	<b>PERFORM</b>	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. CJP groove welds	OBSERVE	<b>[NOTE: DOR must delete this row if section D (SEISMIC PROVISIONS SECTION) is checked]</b> Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
4. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 341-16: Section J6.2		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
<b>[NOTE: DOR may uncheck this section for projects NOT designed in accordance with AISC 341 (Seismic Provisions) or for projects designed according to AISC 341, but using an R value equal to 3]</b>		
5. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
6. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
7. K-area NDT (AISC 341)	PERFORM	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
8. Placement of reinforcing or contouring fillet welds	DOCUMENT	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION <sup>1</sup>****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 360-16: Table N6.1, AISC 341-16: Table J9.1		
TASK	INSPECTION TYPE <sup>2</sup>	DESCRIPTION
1. Placement and installation of steel headed stud anchors	<b>PERFORM</b>	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has not been re-bent in the field	OBSERVE	
6. Reinforcing clearances have been provided	OBSERVE	
7. Reinforcing steel has been tied and supported as required	OBSERVE	
8. Composite member has required size	OBSERVE	

**END SECTION****STRUCTURAL - STEEL - OTHER INSPECTIONS****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.2.1, AISC 341-16: Tables J8.1 & J10.1		
TASK	INSPECTION TYPE <sup>2</sup>	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	<b>PERFORM</b>	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	<b>DOCUMENT</b>	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	<b>DOCUMENT</b>	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	<b>DOCUMENT</b>	No holes or unapproved attachments made by the responsible contractor

**END SECTION**<sup>1</sup> See Concrete Construction Section for all concrete related inspection of composite steel construction.

<sup>2</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION <u>PRIOR TO</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	<b>PERFORM</b>	
2. Document acceptance or rejection of deck and deck accessories	<b>DOCUMENT</b>	
METAL DECK INSPECTION <u>DURING</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
3. Verify compliance of deck and all deck accessories installation with construction documents	<b>PERFORM</b>	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	<b>PERFORM</b>	
5. Document acceptance or rejection of installation of deck and deck accessories	<b>DOCUMENT</b>	
METAL DECK INSPECTION <u>AFTER</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
6. Welding procedure specification (WPS) available	<b>PERFORM</b>	
7. Manufacturers certifications for welding consumables available	<b>OBSERVE</b>	
8. Material identification (type/grade)	<b>OBSERVE</b>	
9. Check welding equipment	<b>OBSERVE</b>	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION <u>DURING</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION <u>AFTER</u> WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	<b>PERFORM</b>	
6. Welds meet visual acceptance criteria	<b>PERFORM</b>	
7. Verify repair activities	<b>PERFORM</b>	
8. Document acceptance or rejection of welds	<b>DOCUMENT</b>	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION <u>BEFORE</u> MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
METAL DECK INSPECTION <u>DURING</u> MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
3. Fasteners are positioned as required	OBSERVE	
4. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION <u>AFTER</u> MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
5. Check spacing, type, and installation of support fasteners	<b>PERFORM</b>	
6. Check spacing, type, and installation of sidelap fasteners	<b>PERFORM</b>	
7. Check spacing, type, and installation of perimeter fasteners	<b>PERFORM</b>	
8. Verify repair activities	<b>PERFORM</b>	
9. Document acceptance or rejection of mechanical fasteners	<b>DOCUMENT</b>	

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.  
**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.  
**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

LIGHT GAUGE STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.2, 1705.11.2, 1705.11.3, UFC 4 023 03		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Trusses spanning 60-feet or greater where/if applies	<b>PERFORM</b>	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds composing part of the main wind or seismic force resisting system, including shearwalls, braces, collectors (drag struts), and hold-downs. <b>[NOTE: DOR must identify critical wind and/or seismic force resisting welds in the contract drawings so that the special inspector can confirm compliance.]</b>
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs. <b>[NOTE: DOR must identify critical wind and/or seismic force resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]</b>
4. Cold-formed steel (progressive collapse resisting system where/if applies)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03). <b>[NOTE: DOR must identify critical progressive collapse resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]</b>

**END SECTION****STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	<ul style="list-style-type: none"> <li>✓ End connections – welded or bolted</li> <li>✓ Bridging – horizontal and diagonal</li> </ul>

**END SECTION**

<sup>1</sup> **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.

**OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.



**STRUCTURAL - CONCRETE CONSTRUCTION SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	OBSERVE	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
2. Reinforcing bar welding	OBSERVE	<ul style="list-style-type: none"> <li>✓ Verify weldability of reinforcing bars other than ASTM A 706</li> <li>✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4</li> </ul>
3. All other welding	CONTINUOUS	Visually inspect all welds in accordance with AWS D1.4
4. Cast in place anchors and post installed drilled anchors (downward inclined)	OBSERVE	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
5. Post-installed adhesive anchors in horizontal or upward inclined orientations	CONTINUOUS AND DOCUMENT	<ul style="list-style-type: none"> <li>✓ Inspect as required per approved ICC-ES report</li> <li>✓ Verify that installer is certified for installation of horizontal and overhead installation applications</li> <li>✓ Inspect proof loading as required by the contract documents</li> </ul>
6. Verify use of required mix design	OBSERVE	Verify that all mixes used comply with the approved construction documents
7. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	CONTINUOUS	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.
8. Inspect concrete and/or shotcrete placement for proper application techniques	CONTINUOUS	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
9. Verify maintenance of specified curing temperature and technique	OBSERVE	Inspect curing, cold weather protection, and hot weather protection procedures.
10. Pre-stressed concrete	CONTINUOUS	Verify application of prestressing forces and grouting of bonded prestressing tendons.

**CONTINUED ON FOLLOWING PAGE**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

**STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)**

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
11. Inspect erection of precast concrete members	OBSERVE	
12. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	OBSERVE	
13. Inspect formwork for shape, location and dimensions of the concrete member being formed.	OBSERVE	

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**DOCUMENT:** Document in a report that the work has been performed as required. This is in addition to all other required reports.

**CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

**STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>AT START</u> OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Compliance with approved submittals prior to start	OBSERVE	
2. Proportions of site-mixed mortar.	OBSERVE	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	OBSERVE	
4. Prestressing technique	OBSERVE	
5. Properties of thin bed mortar for AAC masonry	OBSERVE	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>PRIOR TO</u> GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
6. Grout space	<b>OBSERVE</b> <b>CONTINUOUS</b>	[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	OBSERVE	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	OBSERVE	
9. Placement of masonry units and mortar joints	OBSERVE	
10. Welding of reinforcement	<b>CONTINUOUS</b>	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>DURING</u> CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
11. Size and location of structural elements is in compliance	OBSERVE	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°C) or hot weather (temp above 90°F (32.2°C))	OBSERVE	
13. Application and measurement of prestressing force	<b>CONTINUOUS</b>	
14. Placement of grout and prestressing grout for bonded tendons	<b>CONTINUOUS</b>	
15. Placement of AAC masonry units and construction of thin bed mortar joints	<b>CONTINUOUS</b>	Continuous for first 5000 square feet only (465 square meters).
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	OBSERVE	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	<b>OBSERVE</b> <b>CONTINUOUS</b>	[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/III]

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

**STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. High-load diaphragms where applicable	OBSERVE	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	OBSERVE	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

**END SECTION****STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION****THIS SECTION IS APPLICABLE IF BOX IS CHECKED: ☒**

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC 1705.11 & 1705.12.2		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
<b>[NOTE: DOR may uncheck this section where sheathing nailing/fasteners (both shearwall and roof) are consistently greater than 4" on center, or if the design wind speed (ASD) is less than 110 mph (49 meters/sec) AND the seismic design category is A or B]</b>		
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	OBSERVE (CONTINUOUS FOR GLUING)	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors (double top plates), braces, hold downs, roof connections to exterior walls.

**END SECTION****STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE 2018 IBC TABLE 1705.12.8		
<b>[NOTE: This section is <u>not</u> applicable to Seismic Design Category A. Uncheck this section if this category applies]</b>		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Fabrication and installation	OBSERVE	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents
2. Testing of seismic isolation Systems in seismically isolated structures		Seismic Isolation Systems in seismically isolated structures shall be tested accordance with ASCE 7, Section 17.8

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**GEOTECHNICAL - SOILS INSPECTION SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	OBSERVE	
2. Excavations are extended to proper depth and have reached proper material	OBSERVE	
3. Perform classification and testing of compacted fill materials	<b>OBSERVE</b>	
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	<b>CONTINUOUS</b>	
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	OBSERVE	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

**END SECTION****GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.7		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	<b>CONTINUOUS</b>	
2. Inspect driving operations and maintain complete and accurate records for each element	<b>CONTINUOUS</b>	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	<b>CONTINUOUS</b>	
4. Determine capacities of test elements and conduct additional load tests if required.	<b>CONTINUOUS</b>	
5. For steel or concrete elements, perform additional special inspections in accordance with the Steel and Concrete sections in this schedule		

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

**GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.9

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required. The approved geotechnical report and the contract documents shall be used to determine compliance	<b>CONTINUOUS</b>	

**END SECTION****GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

CAST IN PLACE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.8

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	<b>CONTINUOUS</b>	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	<b>CONTINUOUS</b>	For concrete elements, perform additional special inspections in accordance with the Concrete section in this schedule

**END SECTION**

<sup>1</sup> **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

**FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

SPRAYED FIRE RESISTANT MATERIALS (SFRM) – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.14

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Substrate condition	OBSERVE	Prior to application, confirm that surfaces have been prepared according to the approved fire-resistance design and manufacturer's instructions.
2. Material thickness	OBSERVE	Verify SFRM thickness according to 2018 IBC 1705.14.4
3. Material density	OBSERVE	Verify SFRM density according to 2018 IBC 1705.14.5
4. Bond strength	OBSERVE	Verify bond strength of cured SFRM according to IBC 1705.14.6

**END SECTION****FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.15

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Inspect according to AWCI 12-B and the contract documents	OBSERVE	Inspections shall be performed in accordance with AWCI 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials.

**END SECTION****FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.17

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	OBSERVE	[NOTE: This section applies to Risk Category III, IV, & V only. DOR may choose to uncheck this section where project is assigned to Risk Category I or II. Confirm Risk Category with Structural Engineer]
2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	OBSERVE	

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

**FIRE PROTECTION – SMOKE CONTROL SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒****SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.18**

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Verify device locations and perform leakage testing	OBSERVE	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	OBSERVE	Perform prior to occupancy and after sufficient completion

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.



**ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.16

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	OBSERVE	Verify that water resistive barrier coating complies with ASTM E 2570. <b>[NOTE: not applicable to masonry or concrete wall applications. Uncheck this section in those cases]</b>

**END SECTION****ARCHITECTURAL – ARCHITECTURAL COMPONENTS****ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒**

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE  
2018 IBC 1705.12.5, 1705.12.7

TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
<b>[NOTE: This section is not applicable to Seismic Design Categories A, B, &amp; C. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with the structural engineer]</b>		
1. Erection and fastening of exterior cladding and interior and exterior veneer.	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. <b>Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf</b>
2. Interior and exterior non-load bearing walls	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. <b>Inspector Note: Inspection not required if interior non-load bearing walls weigh less than 15psf</b>
3. Access floors	OBSERVE	Verify that anchorage complies with approved construction documents.
4. Storage racks	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. <b>Inspector Note: Not required for racks less than 8 feet in height</b>

**END SECTION**

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

## PLUMBING/MECHANICAL/ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

ALL OR PORTIONS OF THIS SECTION ARE APPLICABLE IF BOX IS CHECKED: ☒

PLUMBING, MECHANICAL AND ELECTRICAL IBC 1705.12.6		
TASK	INSPECTION TYPE <sup>1</sup>	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A or B. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with structural engineer]		
1. Anchorage of electrical equipment for emergency and standby power systems	OBSERVE	✓ Check for general conformance
2. Anchorage of all other electrical equipment in Seismic Design Categories E and F only (See first page of this schedule for Seismic Design Category)	OBSERVE	✓ Check for general conformance
3. Installation and anchorage of piping designed to carry hazardous materials and their associated mechanical units.	OBSERVE	✓ Check for general conformance
4. Installation and anchorage of vibration isolation systems where the construction documents require a nominal clearance of ¼" or less between support framing and restraint.	OBSERVE	✓ Check for general conformance
5. Verification of clearance between fire sprinkler piping and surrounding mechanical and electrical equipment, including ductwork, piping and their structural supports.	OBSERVE	✓ Check for minimum clearances noted in ASCE7 13.2.3 or a nominal clearance of not less than 3 inches

END SECTION

<sup>1</sup> **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

11/20, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (2017) Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 241 (2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2009; Rev 2012) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 BACKFLOW PREVENTERS CERTIFICATE

1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (58 mph) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

- a. Condition FOUR (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat

piles less than 3.3 feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

- b. Condition THREE (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.
- c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.
- d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

#### 1.6 CYBERSECURITY DURING CONSTRUCTION

{For Reference Only: This subpart (and its subparts) relates to AC-18, SA-3, CCI-00258.} Meet the following requirements throughout the construction process.

##### 1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

###### 1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

###### 1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

###### 1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one

special character.

#### 1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company.

#### 1.6.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

##### 1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

#### 1.6.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

#### 1.6.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

#### 1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

#### 1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

## PART 2 PRODUCTS

### 2.1 TEMPORARY SIGNAGE

#### 2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

#### 2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

#### 2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry designating the construction site as a hard hat area.

### 2.2 TEMPORARY TRAFFIC CONTROL

#### 2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract in accordance with EM 385-1-1 Section 04. Construct with suitable grades and widths; avoid sharp curves, blind corners, and dangerous cross traffic. Submit haul road plan for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haul roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

#### 2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of

the hazard during both day and night.

## 2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

### 2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

### 2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

### 2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 6 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Completely remove fencing and posts at the completion of construction and restore surfaces disturbed or damaged to its original condition. Locate and identify underground utilities prior to setting fence posts. Equip fence with a lockable gate. Gate must remain locked when construction personnel are not present.

## 2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

## 2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements



## Repair Steam Sterilization Plant (SSP)

AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts.

### PART 3 EXECUTION

#### 3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

#### 3.2 AVAILABILITY AND USE OF UTILITY SERVICES

##### 3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

##### 3.2.2 Payment for Utility Services

- a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve utilities furnished without charge.
- b. Reasonable amounts of the following utilities will be made available at the prevailing rates.
- c. The point at which the Government will deliver such utilities or services and the quantity available is as indicated. Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections.
- d. The Contractor must provide their own utilities.

##### 3.2.3 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

##### 3.2.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of \$50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be

billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

### 3.2.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated appurtenances. Pay all outstanding utility bills before final acceptance of the work by the Government.

### 3.2.6 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1 Section 02. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

### 3.2.7 Telephone

Make arrangements and pay all costs for telephone facilities desired.

### 3.2.8 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

## 3.3 TRAFFIC PROVISIONS

### 3.3.1 Maintenance of Traffic

- a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.
- b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

- c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.
- d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

### 3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

### 3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

### 3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

## 3.4 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and monthly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

### 3.5 CONTRACTOR'S TEMPORARY FACILITIES

Contractor-owned or -leased trailers must be identified by Government assigned numbers. Size and location of the number will comply with installation standards. Apply the number to the trailer within 14 calendar days of notification, or sooner, if directed by the Government. Temporary facilities must meet requirements as identified in EM 385-1-1 Section 04.

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1 Section 04. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

#### 3.5.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

In the event a new building is constructed for the temporary project field office, it must be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery-operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, provide air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

#### 3.5.2 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at

the end of each work day.

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, must be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

### 3.5.3 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

### 3.5.4 Appearance of Trailers

- a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.
- b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

### 3.5.5 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

### 3.5.6 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

#### 3.5.6.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and

## Repair Steam Sterilization Plant (SSP)

removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

### 3.6 GOVERNMENT FIELD OFFICE

Government Field Office is not required.

### 3.7 PLANT COMMUNICATIONS

Whenever the individual elements of the plant are located so that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices and make available for use by Government personnel.

### 3.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

### 3.9 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

### 3.10 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS  
11/15, CHG 5: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846 (Third Edition; Update IV) Test Methods  
for Evaluating Solid Waste:  
Physical/Chemical Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.120 Hazardous Waste Operations and Emergency  
Response

29 CFR 1910.1053 Respirable Crystalline Silica

29 CFR 1926.1153 Respirable Crystalline Silica

40 CFR 50 National Primary and Secondary Ambient Air  
Quality Standards

40 CFR 60 Standards of Performance for New  
Stationary Sources

40 CFR 63 National Emission Standards for Hazardous  
Air Pollutants for Source Categories

40 CFR 64 Compliance Assurance Monitoring

40 CFR 112 Oil Pollution Prevention

40 CFR 122.26 Storm Water Discharges (Applicable to  
State NPDES Programs, see section 123.25)

40 CFR 152 Pesticide Registration and Classification  
Procedures

40 CFR 152 - 186 Pesticide Programs

40 CFR 241 Guidelines for Disposal of Solid Waste

40 CFR 243 Guidelines for the Storage and Collection  
of Residential, Commercial, and  
Institutional Solid Waste

40 CFR 258 Subtitle D Landfill Requirements

40 CFR 260 Hazardous Waste Management System: General

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40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261.7	Residues of Hazardous Waste in Empty Containers
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.31	Standards Applicable to Generators of Hazardous Waste-Labeling
40 CFR 262.34	Standards Applicable to Generators of Hazardous Waste-Accumulation Time
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.3	Standards for Universal Waste Management - Pesticides
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for



Existing and New Sources of Pollution

49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.  
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other

pollutants.

#### 1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

#### 1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

#### 1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

#### 1.2.9 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

#### 1.2.10 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

#### 1.2.11 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by installations to obtain NPDES permit coverage for their stormwater discharges.

#### 1.2.12 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

#### 1.2.13 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

#### 1.2.14 Pesticide

Pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

#### 1.2.15 Pesticide Treatment Plan

A plan for the prevention, monitoring, and control to eliminate pest infestation.

#### 1.2.16 Pests

Pests are arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

#### 1.2.17 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual who resides at a Civil Works Project office and who is responsible overseeing of pesticide application on project grounds.

#### 1.2.18 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

#### 1.2.19 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

#### 1.2.20 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

##### 1.2.20.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

##### 1.2.20.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

##### 1.2.20.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

##### 1.2.20.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

##### 1.2.20.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint

contaminated may be included as recyclable if sold to a scrap metal company. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

#### 1.2.20.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

#### 1.2.20.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

#### 1.2.20.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

#### 1.2.21 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, creeks or "waters of the United States". Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

#### 1.2.22 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

##### 1.2.22.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

#### 1.2.23 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

#### 1.2.24 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

### 1.2.25 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Preconstruction Survey

Solid Waste Management Permit; G

Regulatory Notifications; G

Environmental Protection Plan; G

Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities); G

Dirt and Dust Control Plan; G

Employee Training Records; G

Environmental Manager Qualifications; G

#### SD-06 Test Reports

Laboratory Analysis

Monthly Solid Waste Disposal Report; G

#### SD-07 Certificates

Employee Training Records; G

Certificate of Competency

Erosion and Sediment Control Inspector Qualifications

#### SD-11 Closeout Submittals

Stormwater Pollution Prevention Plan Compliance Notebook; G

Stormwater Notice of Termination (for NPDES coverage under the

general permit for construction activities); G

Waste Determination Documentation; G

Disposal Documentation for Hazardous and Regulated Waste; G

Assembled Employee Training Records; G

Solid Waste Management Permit; G

Project Solid Waste Disposal Documentation Report; G

Hazardous Waste/Debris Management; G

Regulatory Notifications; G

Sales Documentation; G

Contractor Certification

As-Built Topographic Survey

#### 1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

##### 1.4.1 Conformance with the Environmental Management System

Refer to Appendix C for background information on Environmental Conditions for the DB Contractor and for development of final DB documentation and coordination with USAG and State of Maryland Environmental protections.

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In

addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

#### 1.5 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here and attached at the end of this section.

#### 1.6 QUALITY ASSURANCE

##### 1.6.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

##### 1.6.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 14 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

##### 1.6.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.



Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

#### 1.6.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor compliance with federal, state, local, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

#### 1.6.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with federal, state and local regulatory requirements for RCRA Large Quantity Generator. Provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of

archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Certification as required by state.

#### 1.6.5.1 Pest Control Training

Trained personnel in pest control. Conduct a pest control meeting for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and pest infestation; familiarization with statutory and contractual pest control standards; installation and care of devices, and instruments, if required, for monitoring purposes to ensure adequate and continuous pest control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of waters of the United States, and endangered species and their habitat that are known to be in the area. Provide a Certificate of Competency for the personnel who will be conducting the pesticide application and management of pest control.

#### 1.6.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

### 1.7 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

## Repair Steam Sterilization Plant (SSP)

### 1.7.1 General Overview and Purpose

#### 1.7.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, traffic control plan, Non-Hazardous Solid Waste Disposal Plan, and borrowing material plan.

#### 1.7.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

#### 1.7.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

#### 1.7.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

#### 1.7.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

### 1.7.2 General Site Information

#### 1.7.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

#### 1.7.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

#### 1.7.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental

## Repair Steam Sterilization Plant (SSP)

Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

### 1.7.3 Management of Natural Resources

- a. Land resources
- b. Tree protection
- c. Replacement of damaged landscape features
- d. Temporary construction
- e. Stream crossings
- f. Fish and wildlife resources
- g. Wetland areas

### 1.7.4 Protection of Historical and Archaeological Resources

- a. Objectives
- b. Methods

### 1.7.5 Stormwater Management and Control

- a. Ground cover
- b. Erodible soils
- c. Temporary measures
  - (1) Structural Practices
  - (2) Temporary and permanent stabilization
- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

### 1.7.6 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of hazardous waste.

This item consist of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated

## Repair Steam Sterilization Plant (SSP)

- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268 )
- g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar
- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

### 1.7.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

### 1.7.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

### 1.7.9 Clean Air Act Compliance

#### 1.7.9.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

#### 1.7.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

#### 1.7.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

#### 1.7.9.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

#### 1.7.9.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

#### 1.7.9.6 Compliant Materials

Provide the Government a list of SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

### 1.8 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

b. The following permits will be obtained by the Government:

- (1) Stormwater Management and Sediment & Erosion Control Approval from Maryland Department of the Environment

### 1.9 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

## Repair Steam Sterilization Plant (SSP)

### 1.10 PESTICIDE DELIVERY, STORAGE, AND HANDLING

#### 1.10.1 Delivery and Storage

Deliver pesticides to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Store pesticides according to manufacturer's instructions and under lock and key when unattended.

#### 1.10.2 Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and use the clothing and personal protective equipment specified on the labeling for use during each phases of the application. Furnish SDSs for pesticide products.

### 1.11 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

#### 1.11.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

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### 3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

### 3.1.2 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

### 3.1.3 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the federal, state, and local governments. Construction of stream crossing structures must be in compliance with any required permits including, but not limited to, Clean Water Act Section 404, and Section 401 Water Quality.

The Contracting Officer's approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

## 3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

### 3.2.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 or the State of Maryland General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

#### 3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to



the Contracting Officer for approval, prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the Maryland State General Permit for stormwater discharges from construction sites.

Include the following:

- a. Comply with terms of the state general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with state requirements. Use stateStormwater Pollution Prevention Plan located at [https://mde.maryland.gov/program/water/wwp/pages/gp\\_construction.aspx](https://mde.maryland.gov/program/water/wwp/pages/gp_construction.aspx) to prepare the SWPPP
  - b. Select applicable BMPs from Maryland Department of the Environment (MDE) "2000 Maryland Stormwater Design Manual Volumes I & II" located at .
  - c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.
- 3.2.1.2 Stormwater Notice of Intent for Construction Activities
- Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review and approval.
- Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.
- 3.2.1.3 Inspection Reports
- Submit "Inspection Reports" to the Contracting Officer in accordance with the State of MarylandConstruction General Permit.
- 3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook
- Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the Maryland Department of the Environment (MDE), and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.
- 3.2.1.5 Stormwater Notice of Termination for Construction Activities
- Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency. Prepare as-built topographic survey information required by the permitting agency for certification of the stormwater management system, and provide to the Contracting Officer.

### 3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

#### 3.2.2.1 Erosion Control

Prevent erosion by immediate stabilization of exposed earth. Stabilize slopes by sodding as necessary for effective erosion control. Use of hay bales is prohibited.

#### 3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Include the following devices: silt fence, temporary diversion dikes, storm drain inlet protection, Location and details of installation and construction are indicated on the drawings.

#### 3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

#### 3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

#### 3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

### 3.3 SURFACE AND GROUNDWATER

#### 3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of Maryland water quality standards and anti-degradation provisions. Do not discharge

excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

### 3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

## 3.4 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

### 3.4.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

### 3.4.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

### 3.4.3 Burning

Burning is prohibited on the Government premises.

### 3.4.4 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the appropriate location for turn in of all reclaimed refrigerant.

## Repair Steam Sterilization Plant (SSP)

### 3.4.5 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer.

### 3.4.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

### 3.4.7 Dust Control

Keep dust down at all times, including during nonworking periods. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

#### 3.4.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

#### 3.4.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

### 3.4.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not

constitute a health hazard.

### 3.5 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

#### 3.5.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

#### 3.5.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

## Repair Steam Sterilization Plant (SSP)

Construction and Demolition (C&D) Debris Disposed	tons, as appropriate
C&D Debris Recycled	tons, as appropriate
C&D Debris Composted	tons, as appropriate
Total C&D Debris Generated	tons, as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	tons, as appropriate

### 3.6 WASTE MANAGEMENT AND DISPOSAL

#### 3.6.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 261 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

##### 3.6.1.1 Sampling and Analysis of Waste

###### 3.6.1.1.1 Waste Sampling

Sample waste in accordance with EPA SW-846. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

###### 3.6.1.1.2 Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. Provide analytical results and reports performed to the Contracting Officer.

###### 3.6.1.1.3 Analysis Type

Identify hazardous waste by analyzing for the following characteristics: ignitability, corrosivity, reactivity, toxicity based on TCLP results .

### 3.6.2 Solid Waste Management

#### 3.6.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation Contractor certification must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

#### 3.6.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Comply with site procedures. Segregate and separate treated wood components disposed at a lined landfill approved to accept this waste in accordance with local and state regulations. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

#### 3.6.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

##### 3.6.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved

## Repair Steam Sterilization Plant (SSP)

containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

### 3.6.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262.34 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or 1 quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90 day accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan to the Request):

Contract Number	
Contractor	
Haz/Waste or Regulated Waste POC	
Phone Number	
Type of Waste	
Source of Waste	
Emergency POC	
Phone Number	
Location of the Site	

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

### 3.6.3.3 Hazardous Waste Disposal

#### 3.6.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.



#### 3.6.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

#### 3.6.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

#### 3.6.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

#### 3.6.3.3.1.4 Labeling

Determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

#### 3.6.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

- a. Batteries as described in 40 CFR 273.2
- b. Lamps as described in 40 CFR 273.5
- c. Mercury-containing equipment as described in 40 CFR 273.4
- d. Pesticides as described in 40 CFR 273.3

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

#### 3.6.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

#### 3.6.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

#### 3.6.4 Releases/Spills of Oil and Hazardous Substances

##### 3.6.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

##### 3.6.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

#### 3.6.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

#### 3.6.6 Wastewater

##### 3.6.6.1 Disposal of Wastewater

Disposal of wastewater must be as specified below.

##### 3.6.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up,

## Repair Steam Sterilization Plant (SSP)

water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

### 3.6.6.1.2 Surface Discharge

Surface discharge in accordance with federal, state, and local laws and regulations.

### 3.6.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be land- applied in accordance with federal, state, and local laws and regulations for land application.

## 3.7 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

## 3.8 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

## 3.9 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

## 3.10 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other

barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of oil, including fuel, on the project site is not allowed. Fuel must be brought to the project site each day that work is performed. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

#### 3.10.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

#### 3.10.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

#### 3.11 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

#### 3.12 PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, coordinate with the Installation Pest Management Coordinator (IPMC) or Project Pesticide Coordinator (PPC), through the Contracting Officer, at the earliest possible time prior to pesticide application. Discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC

through the Contracting Officer prior to the application of any pesticide associated with these specifications. Provide Installation Project Office Pest Management personnel the opportunity to be present at meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under 40 CFR 152 - 186.

#### 3.12.1 Application

Apply pesticides using a state-certified pesticide applicator in accordance with EPA label restrictions and recommendation. The certified applicator must wear clothing and personal protective equipment as specified on the pesticide label. The Contracting Officer will designate locations for water used in formulating. Do not allow the equipment to overflow. Inspect equipment for leaks, clogging, wear, or damage and repair prior to application of pesticide.

#### 3.12.2 Pesticide Treatment Plan

Include and update a pesticide treatment plan, as information becomes available. Include in the plan the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (that is, pounds of active ingredient applied), equipment used for application and calibration of equipment. Comply with 40 CFR 152-189, state, regional, and local pest management record-keeping and reporting requirements as well as any additional Installation Project Office specific requirements in conformance with DA AR 200-1 Chapter 5, Pest Management, Section 5-4 "Program requirements" for data required to be reported to the Installation.

#### 3.13 CHLORDANE

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of chlordane or other pesticides prior to reuse or final disposal.

#### 3.14 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Maryland rules.

#### 3.15 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause:

"Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

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SECTION 01 58 00

PROJECT IDENTIFICATION

08/19, CHG 4: 05/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 310-1-6a (2006; 2019 Change 2) Project Operation --  
Sign Standards Manual, VOL 1

EP 310-1-6b (2006) Sign Standards Manual, VOL 2,  
Appendices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sign Legend Orders; G

1.3 QUALITY CONTROL

1.4 PROJECT IDENTIFICATION SIGN

1.4.1 Construction Project Signs

Furnish the construction project sign package, maintain the signs during construction, and remove the signs from the job site upon completion of the project. The construction project sign package consists of two signs: one for project identification and the other to show the on-the-job safety performance of the contractor. Ensure that the package conforms to the requirements of EP 310-1-6a and EP 310-1-6b, specifically Section 16. Submit the sign legend orders as described in Section 16 of EP 310-1-6a before erecting the signs.

Utilize the Example Graphic of Signage with Dimensions for MILCON Project and follow USACE policy provided in Engineering Pamphlet (EP) 310-1-6a, Sign Standards Manual, VOL 1 for guidelines on fabricating, locating, and mounting construction project signs  
([https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/EP\\_310-1-6a%20change%202.pdf](https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/EP_310-1-6a%20change%202.pdf)).

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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

02/19, CHG 3: 11/21

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

1.1.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

1.1.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

1.1.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill or incinerator, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

1.1.5 Diversion

The practice of diverting waste from disposal in a landfill or incinerator, by means of eliminating or minimizing waste, or reuse of materials.

1.1.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

1.1.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

1.1.8 Reuse

The use of a product or materials again for the same purpose, in its

original form or with little enhancement or change.

#### 1.1.9 Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

#### 1.1.10 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

### 1.2 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project construction waste and demolition debris/waste from the landfill or incinerator. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

### 1.3 CONSTRUCTION WASTE MANAGEMENT

Implement a Construction Waste Management Program for the project. Take a pro-active, responsible role in the management of construction construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the Construction Waste Management Program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

#### 1.3.1 Implementation of Construction Waste Management Program

Develop and document how the Construction Waste Management Program will be implemented in a Construction Waste Management Plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

#### 1.3.2 Oversight

The Quality Control Manager, as specified in Section 01 45 00.00 10 QUALITY CONTROL, is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project.

#### 1.3.3 Special Programs

Implement special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise

directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

#### 1.3.4 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

#### 1.3.5 Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the Construction Waste Management Plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste streams not listed:

- a. Land Clearing Debris
- b. Asphalt
- c. Masonry and CMU
- d. Concrete
- e. Metals (Includes, but is not limited to, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze.)
- f. Wood (nails and staples allowed)
- g. Glass
- h. Paper
- i. Plastics (PET, HDPE, PVC, LDPE, PP, PS, Other)
- j. Gypsum
- k. Non-hazardous paint and paint cans
- l. Carpet
- m. Ceiling Tiles
- n. Insulation
- o. Beverage Containers

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan; G

SD-06 Test Reports

Quarterly Reports

Annual Report

SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

1.5 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding relative to the management of the Construction Waste Management Program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

- a. Preconstruction meeting.
- b. Regular site meetings.
- c. Work safety meeting (if applicable).

1.6 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15 days after contract award. Revise and resubmit Construction Waste Management Plan as necessary, in order for construction to begin.. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION . Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved Construction Waste Management Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

- a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on the project..
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.

- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.
- e. Name of landfill and incinerator to be used.
- f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.
- g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.
- h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.
- i. Description of the means by which materials identified in item (g) above will be protected from contamination.
- j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.

Distribute copies of the waste management plan to each subcontractor, Quality Control Manager, and the Contracting Officer.

## 1.7 RECORDS (DOCUMENTATION)

### 1.7.1 General

Maintain records to document the types and quantities of waste generated and diverted through re-use, recycling and sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

### 1.7.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

## 1.8 REPORTS

### 1.8.1 General

Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for the project. Reports must identify quantities of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

### 1.8.2 Quarterly Reporting

Provide cumulative reports at the end of each quarter (December, March, June, and September, corresponding with the federal fiscal year for reporting purposes). Submit quarterly reports not later than 15 calendar days after the preceding quarter has ended. Submit Quarterly Reports to the appropriate office or identified point of contact.

### 1.8.3 Annual Reporting

Provide a cumulative construction waste diversion report annually. Submit annual report not later than 30 calendar days after the preceding fourth quarter has ended. Provide copy of annual construction waste diversion report to the installation POC.

## 1.9 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide Final Construction Waste Diversion Report 60 days prior to the Beneficial Occupancy Date (BOD). The final Construction Waste Diversion Report must be included in the Sustainability eNotebook in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

## 1.10 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the Construction Waste Management Plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Separate materials by one of the following methods described herein:

### 1.10.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and

then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the Construction Waste Management Plan.

#### 1.10.2 Co-Mingled Method

Place waste products and recyclable materials into a single container and then transport to an authorized recycling facility, which meets all applicable requirements to accept and dispose of recyclable materials in accordance with all applicable local, state and federal regulations. The Co-mingled materials must be sorted and processed in accordance with the approved Construction Waste Management Plan.

#### 1.10.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

### 1.11 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

#### 1.11.1 Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved Construction Waste Management Plan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is not allowed on the Installation. Consider the use of surplus industrial supply broker services, who match entities with reusable or repurpose industrial materials with entities with need of such materials.

#### 1.11.2 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

#### 1.11.3 Compost

Consider composting on site if a reasonable amount of compostable materials will be available and a utilization of compostable material can be determined and appropriately planned for. Compostable materials include plant materials, sawdust and certain food scraps. Composting as a

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strategy must be explicitly addressed in the Construction Waste Management Plan submitted for approval to ensure it is feasible.

### 1.11.4 Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

Not used.           -- End of Section --



SECTION 01 78 00

CLOSEOUT SUBMITTALS

05/19, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-2909	(2012) Engineering and Design -- Geospatial Data and Systems
ERDC/ITL TR-19-6	(2019) A/E/C Graphics Standard, Release 2.1
ERDC/ITL TR-19-7	(2019) A/E/C CAD Standard - Release 6.1

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009; with Change 2, 2011) Criteria for Transfer and Acceptance of DoD Real Property
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1.2 DEFINITIONS

1.2.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site or red-lined PDF files. These files serve as the basis for the creation of the record drawings.

1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

1.2.3 Record Model

A model reflecting approved changes during construction including red-lines, requests for information (RFI's), and contract modifications. Include updated construction phase facility/site data for components.

1.2.4 Advanced Modeling

A subset of geospatial technologies as defined in EM 1110-1-2909 to

include Building Information Modeling (BIM), Civil Information Modeling (CIM), Geographic Information Systems (GIS), and Computer-Aided Design (CAD). Advanced modeling is comprised of models and drawings that form a digital representation of the project, or part thereof, that are comprised of model elements with facility data.

#### 1.2.5 USACE CAD/BIM Technology Center

The USACE CAD/BIM Technology Center hosts all standard content for USACE. This content can be accessed through the CAD/BIM Technology Center website, <https://cadbimcenter.erdc.dren.mil/>.

#### 1.3 SOURCE DRAWING FILES

Request the full set of electronic drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

##### 1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

#### 1.4 RECORD DRAWINGS

The Government will provide pdf and or program files at the preconstruction conference that contains one set of "as-designed" electronic CAD files in the specified software and format revised to reflect all amendments and the final contract PDF drawings. The CAD files are provided to enable preparation of as-built or as-constructed drawings. If discrepancies exist between the CAD files and the contract PDF drawings, correct the CAD files to show the contract PDF drawings.

#### 1.4.1 Variation with Contract Drawings

The electronic files provided are not part of the contract documents. If there is any discrepancy between the electronic files and the contract drawings, the contract drawings govern. The Government has no responsibility to modify any GFM due to changes in the design that occur after award.

Evaluate the content and quality of the GFM upon receipt. If major discrepancies or omissions occur in the GFM, notify the Contracting Officer and indicate the nature of such variations.

#### 1.4.2 Data Loss, Corruption, and Error

Transfer of GFM files may result in corrupted files resulting in data loss and errors. Use of GFM files at own risk. Verify data integrity upon receipt and request a replacement if necessary. Make any adjustment in file structure, format, or software version as needed to make GFM compatible with computer systems and/or software to meet the requirements of the contract.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

Warranty Management Plan

Warranty Tags

Spare Parts Data

##### SD-08 Manufacturer's Instructions

Posted Instructions

##### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

##### SD-11 Closeout Submittals

As-Built Drawings; G

Record Drawings; G

Record Model; G

As-Built Record of Equipment and Materials

Final Approved Shop Drawings; G

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Construction Contract Specifications; G

Certification of EPA Designated Items; G

Interim DD FORM 1354; G

Checklist for DD FORM 1354; G

High Performance and Sustainable Building (HPSB) Checklist; G

### 1.6 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, and stock level required for test and balance, pre-commissioning, maintenance and repair activities. List those items that may be standard to the normal maintenance of the system.
- b. At acceptance of commissioning, ensure the required stock level is supplied as indicated in subparagraph a for maintenance and repair activities through the facilities warranty period. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

### 1.7 QUALITY CONTROL

Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must conform to ERDC/ITL TR-19-7.

### 1.8 WARRANTY MANAGEMENT

#### 1.8.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Conduct a joint 4 month and 9 month warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

- a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or

suppliers involved.

- b. For each warranty, the name, address, telephone number, and e-mail of each of the guarantor's representatives nearest to the project location.
- c. A list and status of delivery of Certificates of Warranty for extended warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.
- d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:
  - (1) Name of item.
  - (2) Model and serial numbers.
  - (3) Location where installed.
  - (4) Name and phone numbers of manufacturers or suppliers.
  - (5) Names, addresses and telephone numbers of sources of spare parts.
  - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have warranties longer than one year must be indicated with separate warranty expiration dates.
  - (7) Cross-reference to warranty certificates as applicable.
  - (8) Starting point and duration of warranty period.
  - (9) Summary of maintenance procedures required to continue the warranty in force.
  - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (11) Organization, names and phone numbers of persons to call for warranty service.
  - (12) Typical response time and repair time expected for various warranted equipment.
- e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of equipment covered by warranties longer than one year.
- g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

#### 1.8.2 Performance Bond

The Performance Bond must remain effective throughout the construction period .

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.8.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.8.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

- a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
- b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
- c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.
- d. The "Construction Warranty Service Priority List" is as follows:

##### Code 1-Life Safety Systems

- (1) Fire suppression systems.
- (2) Fire alarm system(s) in place in the building.

##### Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

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### Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

### Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

### Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

### Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

### Code 3-Electrical

Street lights.

### Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

### Code 1-Heat

- (1) Area power failure affecting heat.
- (2) Heater in unit not working.

### Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

### Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

### Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

### Code 3 -Plumbing

Leaky faucets.

### Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

### Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

### Code 2-Roof Leaks

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Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)  
No water to facility.

Code 2-Water (Hot)  
No hot water in portion of building listed.

Code 3-All other work not listed above.

### 1.8.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	



## PART 2 PRODUCTS

### 2.1 RECORD DRAWINGS

Prepare the CAD drawing files in AutoCAD Release 2021 format compatible with a Windows 10 operating system.

#### 2.1.1 Additional Drawings

If additional drawings are required, prepare them using the specified electronic file format applying ERDC/ITL TR-19-7 and ERDC/ITL TR-19-6. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings.

##### 2.1.1.1 Sheet Numbers and File Names

If a sheet needs to be added between two sequential sheets, append a Supplemental Drawing Designator in accordance with ERDC/ITL TR-19-7 Adding a drawing sheet, and ERDC/ITL TR-19-6 Adding or deleting drawing sheets and index sheet procedures.

### 2.2 ADVANCED MODELING PACKAGE

For each Advanced Modeling Package submittal for both the Interim Record Model Package and the Final Record Model Package, submit in accordance with ERDC/ITL TR-19-7 and in accordance with Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) and also provide the following items:

- a. Advanced Modeling PxP: Provide an electronic copy of the most current approved version of the project Advanced Modeling PxP.
- b. Electronic Files: Provide an electronic list (.txt file or similar), of all submitted electronic files including a description, directory, and file name for each file submitted. Identify which files have been produced from the Model and Facility Data. For all sheet files, include a list of the sheet titles and sheet numbers.
- c. Advanced Modeling Submittal Checklist: Complete the USACE BIM/CIM Advanced Modeling Submittal Checklist and include with each submittal. Download the Checklist from the USACE CAD/BIM Technology Center website.
- d. Advanced Modeling Files: Provide all native Advanced Modeling files associated with the production of the contract drawings and associated as-modeled drawings. Update and maintain in compliance with the Advanced Modeling formatting, content requirement, and standards in Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) , in order to yield a complete and coordinated document package.
- e. Quality Control (QC) Reports: Provide electronic PDFs of all QC reports and checklist utilized to ensure full compliance with the contract requirements and standards.
- f. CAD Exports of BIM-Generated Sheets and Drawings: Provide supplemental 2D CAD exports from the project BIM model as needed to demonstrate compliance with contract requirements. Export all contract drawings sheets to the CAD format(s) defined in Section 01 33 16.00 10 DESIGN DATA(DESIGN AFTER AWARD).

## 2.3 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA Designated Items and FAR 52-223-17 Affirmative Procurement of EPA designated items in Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

- a. The product does not meet appropriate performance standards;
- b. The product is not available within a reasonable time frame;
- c. The product is not available competitively (from two or more sources);
- d. The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

Record each product used in the project that has a requirement or option of containing recycled content in accordance with SECTION 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (a, b, c, or d, as indicated), and comments. Recycled content values may be determined by weight or volume percent, but must be consistent throughout.

## 2.4 PDF AS-BUILT FILES

Provide electronic PDF "plots" of all contract drawings sheets associated with the as-built drawing submittal. Compile and organize the PDF set to match the contract drawings. Bookmark and label the pages of the PDF file in accordance with Section 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD).

## 2.5 REDLINES AND MARKUPS

Provide PDFs of the current working redlines and/or markups complying with the as-builts drawing and markup requirements contained in this specification.

## 2.6 AS-BUILT OR ADVANCED MODELING RE-SUBMISSION REQUIREMENTS

If elements of an as-built submittal or advanced modeling package are rejected, provide the following for each re-submission, in addition to any information required in Section 01 33 00 SUBMITTAL PROCEDURES:

- a. Re-submit all components required under paragraph As-Builts or Advanced Modeling Package, including a new Advanced Modeling Submittal Checklist and updated content in response to Government comments.
- b. Provide a copy of all Government review comments.
- c. Provide a disposition/response to each Government review comment for a back-check of the re-submission deliverable.

## PART 3 EXECUTION

### 3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site or red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

#### 3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

- a. Use base colors of red, green, and blue. Color code for changes as follows:
  - (1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.
  - (2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
  - (3) Additions (Green) - Added items, lettering in notes and leaders.
- b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.
- c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.
- d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.
- e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.
- f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.
- g. For deletions, cross out all features, data and captions that relate to that revision.
- h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.
- i. Indicate one of the following when attaching a print or sketch to a markup print:
  - 1) Add an entire drawing to contract drawings

- 2) Change the contract drawing to show changes on the drawing.
- 3) Provided for reference only to further detail the initial design.

j. Incorporate all shop and fabrication drawings into the markup drawings.

### 3.1.2 As-Built Drawings Content

Revise As-Built Drawings in accordance with ERDC/ITL TR-19-6 and ERDC/ITL TR-19-7. Keep these working as-built markup drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract drawings which are made during construction or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Submit the working as-built markup drawings for approval prior to submission of each monthly pay estimate. For failure to maintain the working and final record drawings as specified herein, the Contracting Officer will withhold 10 percent of the monthly progress payment until approval of updated drawings. Show on the as-built drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.
- b. The location and dimensions of any changes within the building structure.
- c. Layout and schematic drawings of electrical circuits and piping.
- d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.
- f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- g. Changes or Revisions which result from the final inspection.
- h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

- j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- k. Changes in location of equipment and architectural features.
- l. Modifications.
- m. Actual location of anchors, construction and control joints, etc., in concrete.
- n. Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- o. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

### 3.2 RECORD DRAWING FILES

If additional drawings are required, prepare them using the specified electronic file format applying ERDC/ITL TR-19-7 and ERDC/ITL TR-19-6. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CAD files. Provide all program files and hardware necessary to prepare final PDF record drawings. The Contracting Officer will review final PDF record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

#### 3.2.1 Rename the CAD Drawing files

Rename the CAD Drawing files using the contract number as the Project Code field, (e.g., W91238-15-C-10A-102.DWGDGN) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. Make all changes on the layer/level as the original item.

- a. For AutoCAD files (DWG), enter all as-built delta changes and notations on the AS-BUILT layer. MicroStation files (DGN), enter all as-built delta changes and notations on:
  - Level #63
  - Level/Layer Name contains: ANNO-REVS
  - Level/Layer Description: Revisions
- b. When final revisions have been completed, show the wording "RECORD DRAWING AS-BUILTS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Date RECORD DRAWING AS-BUILTS" drawing revisions in the revision block.
- c. Within 20 days after Government approval of all of the working record drawings for a phase of work, prepare the final CAD record drawings for that phase of work and submit PDF drawing files and two sets of prints for review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days revise the CAD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic CAD files, and one set of the approved

working record PDF and or programfiles with two sets of prints. The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government. Prepare AutoCAD files for transmittal using e-Transmit. Prepare MicroStation files for transmittal using the Packager (Archive). Make any transactions or adjustments necessary to accomplish this. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record PDF drawing files, CAD files and marked prints as specified will be cause for withholding any payment due under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made.

### 3.3 RECORD DRAWINGS

Prepare final record drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (such as Foundations, Utilities, or Structural Steel as appropriate for the project). Transfer the changes from the approved working as-built markup drawings to the original electronic CAD drawing files. Modify the as-built CAD drawing files to correctly show the features of the project as-built by bringing the working CAD drawing set into agreement with approved working as-built markup drawings, and adding such additional drawings as may be necessary. Refer to ERDC/ITL TR-19-6. Jointly review the working as-built markup drawings with printouts from working as-built CAD drawing PDF files for accuracy and completeness. Monthly review of working as-built CAD drawing PDF file printouts must cover all sheets revised since the previous review. These PDF drawing files are part of the permanent records of this project. Any drawings damaged or lost must be satisfactorily replaced at no expense to the Government.

Drawing revisions (include within change order price the cost to change working and final record drawings to reflect revisions) and compliance with the following procedures.

- a. Follow directions in the revision for posting descriptive changes.
- b. The revision delta size must be 5/16 inch unless the area where the delta is to be placed is crowded. Use a smaller size delta for crowded areas.
- c. Place a revision delta at the location of each deletion.
- d. For new details or sections which are added to a drawing, place a revision delta by the detail or section title.
- e. For minor changes, place a revision delta by the area changed on the drawing (each location).
- f. For major changes to a drawing, place a revision delta by the title of the affected plan, section, or detail at each location.
- g. For changes to schedules or drawings, place a revision delta either by the schedule heading or by the change in the schedule.

### 3.3.1 Final Record Drawing Package

Submit the final record PDF and CAD drawings package for the entire project within 20 days of substantial completion of all phases of work. Submit one set of ANSI D size PDF and CAD files, two sets of ANSI D size prints and one set of the approved working record drawings. The package must be complete in all details and identical in form and function to the contract drawing files supplied by the Government.

### 3.4 FINAL APPROVED SHOP DRAWINGS

Submit final approved project shop drawings 30 days after transfer of the completed facility.

### 3.5 CONSTRUCTION CONTRACT SPECIFICATIONS

Submit final PDF file record construction contract specifications, including revisions thereto, 30 days after transfer of the completed facility.

### 3.6 AS-BUILT RECORD OF EQUIPMENT AND MATERIALS

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

### 3.7 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide four electronic copies of the Operation and Maintenance Manual files and one hard copy of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 30 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

### 3.8 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean

landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site..

### 3.9 REAL PROPERTY RECORD

Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354.

#### 3.9.1 Interim DD FORM 1354

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft DD FORM 1354 attached to this section, and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354.

#### 3.9.2 Completed DD FORM 1354

For convenience, a blank fillable PDF DD FORM 1354 may be obtained at the following link:

[www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf](http://www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf)

Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --



# TRANSFER AND ACCEPTANCE OF DoD REAL PROPERTY

Form Approved  
OMB No. 0704-0188

PAGE OF PAGES

The public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, 4800 Mark Center Drive, Alexandria, VA 22350-3100 (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.**

<b>1. FROM</b> (Organization Name)				<b>2. DATE PREPARED</b> (YYYYMMDD)		<b>3. PROJECT/JOB NUMBER</b>		<b>4. SERIAL NUMBER</b>		<b>8. TRANSACTION DETAILS</b>					
<b>5. TO</b> (Organization - Installation Code and Name)				<b>6. RPSUID/SITENAME/ INSTCODE/INSTNAME</b>		<b>7. CONTRACT NUMBER(S)</b>		<b>7a. PLACED-IN-SERVICE DATE</b> (YYYYMMDD)		<b>a. METHOD</b> (X all that apply) <input type="checkbox"/> ACQUISITION BY CONSTRUCTION <input type="checkbox"/> TRANSFER BETWEEN SERVICES <input type="checkbox"/> CAPITAL IMPROVEMENT <input type="checkbox"/> INVENTORY ADJUSTMENT			<b>b. WHEN/EVENT</b> (X one) <input type="checkbox"/> TOTAL ASSET PLACED-IN-SERVICE <input type="checkbox"/> PARTIAL ASSET PLACED-IN-SERVICE		
										<b>c. TYPE</b> (X one) <input type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input type="checkbox"/> INTERIM					
9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. SUST. CODE	AREA		OTHER		19. COST	20. FUND SOURCE	21. FUND ORG	22. INTEREST CODE	23. ITEM REMARKS
							15. PRIMARY UM	16. PRIMARY UM QUANTITY	17. SECONDARY UM	18. SECONDARY UM QUANTITY					
<b>24. STATEMENT OF COMPLETION.</b> The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.										<b>25a. ACCEPTED BY</b> (Typed Name and Signature)				<b>b. DATE SIGNED</b> (YYYYMMDD)	
<b>a. TRANSFERRED BY</b> (Typed Name and Signature)						<b>b. DATE SIGNED</b> (YYYYMMDD)				<b>c. TITLE</b> (DPW/RPAO)				<b>26. PROPERTY VOUCHER NUMBER</b>	
<b>c. TITLE</b> (Area Engr./Base Engr./DPW/Construction Agent)															

**27. CONSTRUCTION DEFICIENCIES** (Attach blank sheet for continuations)

**28. PROJECT REMARKS** (Attach blank sheet for continuations)

### INSTRUCTIONS

**GENERAL.** This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instructions issued by the military departments relative to the preparation of DD Form 1354 are applicable to this revised form to the extent that the various items and columns on the superseded forms have been retained. The military departments may promulgate additional instructions, as appropriate.

For detailed instructions on how to fill out this form, please refer to Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009 or later.

#### SPECIFIC DATA ITEMS.

**1. From.** Name of the transferring agency.

**2. Date Prepared.** Date of actual preparation. Enter all dates in YYYYMMDD format (Example: March 31, 2010 = 20100331).

**3. Project/Job Number.** Project number on a DD Form 1391 or Individual Job Order Number.

**4. Serial Number.** Sequential serial number assigned by the preparing organization (e.g., 2010-0001).

**5. To.** Name and address of the receiving installation, activity, and Service of the Real Property Accountable Officer (RPAO).

**6. RPSUID/SITENAME/INSTCODE/INSTNAME.** Site Unique Identifier and name or installation code and name where the constructed facility is located.

**7. Contract Number(s).** Contract number(s) for this project.

**7a. Placed-In-Service Date.** RPA Placed In Service Date. This is the date the asset is actually placed-in-service.

#### 8. Transaction Details.

- a. Method of Transaction. Mark (X) as many boxes as apply.
- b. When/Event. When or event causing preparation of DD Form 1354. X only one box.
- c. Type. Draft, interim, or final DD Form 1354. X only one box.

**9. Item Number.** Use a separate item number for each facility, no item number for additional usages.

**10a. Facility Number.** Assigned in accordance with the Installation/Base Master Numbering Plan.

**10b. RPUID.** Identified in Real Property Inventory.

**11. Category Code.** The category code describes the facility usage.

**12. Catcode Description.** The category code name which describes the facility usage.

**13. Type.** Type of construction: P for Permanent; S for Semi-permanent; T for Temporary.

**14. Sustainability Code.** Reports whether or not an asset meets the sustainability guidelines set forth in Section 2(g) of Executive Order 13514. Valid values are: 1 (asset meets the guidelines); 2 (asset does not meet the guidelines); 3 (asset not evaluated); 4 (asset not subject to guidelines).

**15. Area: UM 1.** Area unit of measure; use the unit of measure associated with the category code selected in 11.

**16. Total Quantity UM 1.** The total area for the measure identified in Item 15. Use negative numbers for demolition.

**17. Other: UM 2.** Unit of Measure 2 is the capacity or other measurement unit (e.g., LF, MB, EA, etc.).

**18. Total Quantity UM 2.** The total capacity/other for the measure identified in Item 17.

**19. Cost.** Cost for each facility; for capital improvements to existing facilities, show amount of increase only. If there is no increase for the capital improvement, enter N/A.

**20. Fund Source.** Enter the Fund Source Code for this item.

**21. Funding Organization.** Enter the code for the organization responsible for acquiring this facility.

**22. Interest Code.** Enter the code that reflects government interest or ownership in the facility.

**23. Item Remarks.** Remarks pertaining only to the item number identified in Item 9; show cost sharing.

**24. Statement of Completion.** Typed name, signature, title, and date of signature by the responsible transferring individual or agent.

**25. Accepted By.** Typed name, signature, title, and date of signature by the RPAO or accepting official.

**26. Property Voucher Number.** Next sequential number assigned by the RPAO in voucher register.

**27. Construction Deficiencies.** List construction deficiencies in project during contractor turnover inspection.

**28. Project Remarks.** Project level remarks and continuation of blocks.

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

08/15, CHG 2: 08/21

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database; G

Training Plan; G

Training Outline; G

Training Content; G

SD-11 Closeout Submittals

Training Video Recording; G

Validation of Training Completion; G

1.2 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.2.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows.

### 1.2.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

### 1.2.4 Commissioning Specialist Review and Approval

Submit the commissioned systems and equipment submittals to the Commissioning Specialist (CxC) to review for completeness and applicability. Obtain validation from the CxC that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CxC communicates deficiencies to the Contracting Officer. Submit the O&M manuals to the Contracting Officer upon a successful review of the corrections, and with the CxC recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal review procedures for O&M data.

## 1.3 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

## 1.4 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

### 1.4.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI MasterFormat numbering system, and arrange submittals using the specification sections as a structure. Use CSI MasterFormat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

### 1.4.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

- a. Building Number
- b. Project Title

## Repair Steam Sterilization Plant (SSP)

- c. Activity and Location
- d. Construction Contract Number
- e. Prepared For: (Contracting Agency)
- f. Prepared By: (Name, title, phone number and email address)
- g. Include the disk content on the disk label
- h. Date
- i. Virus scanning program used

### 1.5 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

#### 1.5.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

##### 1.5.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

##### 1.5.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

##### 1.5.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

##### 1.5.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

##### 1.5.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

#### 1.5.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

#### 1.5.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

#### 1.5.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

#### 1.5.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. Provide a listing of rooms with the following information for each room:
  - (1) Floor
  - (2) Room number
  - (3) Room name
  - (4) Air handler unit ID
  - (5) Reference drawing number
  - (6) Air terminal unit tag ID
  - (7) Heating or cooling valve tag ID
  - (8) Minimum cfm
  - (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

### 1.5.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

#### 1.5.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.5.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

### 1.5.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs.

#### 1.5.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical

malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

#### 1.5.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

#### 1.5.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

#### 1.5.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

#### 1.5.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

#### 1.5.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

#### 1.5.4 Real Property Equipment

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Submit the final list 30 days after transfer of the completed facility.

Key the designations to the related area depicted on the contract drawings. List the following data:



RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

#### 1.5.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

##### 1.5.5.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

##### 1.5.5.2 Certificates

Provide a copy of SD-07 Certificates submittals documented with the required approval.

##### 1.5.5.3 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

##### 1.5.5.4 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

##### 1.5.5.5 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

##### 1.5.5.6 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty

information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.5.5.7 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.5.5.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.5.5.9 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

#### 1.5.5.10 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

#### 1.5.5.11 Field Test Reports and Manufacturer's Field Reports

Provide a copy of Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals documented with the required approval.

#### 1.5.5.12 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.6 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

#### 1.6.1 Data Package 1

- a. Safety precautions and hazards
- b. Cleaning recommendations
- c. Maintenance and repair procedures

## Repair Steam Sterilization Plant (SSP)

- d. Warranty information
- e. Extended warranty information
- f. Contractor information
- g. Spare parts and supply list

### 1.6.2 Data Package 2

- a. Safety precautions and hazards
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan, schedule, and procedures
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Extended warranty information
- m. Contractor information

### 1.6.3 Data Package 3

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Operating log
- h. Lubrication data
- i. Preventive maintenance plan, schedule, and procedures
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques

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- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Product submittal data
- q. O&M submittal data
- r. Parts identification
- s. Warranty information
- t. Extended warranty information
- u. Testing equipment and special tool information
- v. Testing and performance data
- w. Contractor information
- x. Field test reports

### 1.6.4 Data Package 4

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Operating log
- i. Lubrication data
- j. Preventive maintenance plan, schedule, and procedures
- k. Cleaning recommendations
- l. Troubleshooting guides and diagnostic techniques
- m. Wiring diagrams and control diagrams
- n. Repair procedures
- o. Removal and replacement instructions

## Repair Steam Sterilization Plant (SSP)

- p. Spare parts and supply list
- q. Repair work-hours
- r. Product submittal data
- s. O&M submittal data
- t. Parts identification
- u. Warranty information
- v. Extended warranty information
- w. Personnel training requirements
- x. Testing equipment and special tool information
- y. Testing and performance data
- z. Contractor information
- aa. Field test reports

### 1.6.5 Data Package 5

- a. Safety precautions and hazards
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan, schedule, and procedures
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information

- r. Extended warranty information
- s. Testing and performance data
- t. Contractor information
- u. Field test reports
- v. Additional requirements for HVAC control systems

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS.. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

#### 3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Commissioning Specialist (CxC) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and CxC. Include within the plan the following elements:

- a. Equipment included in training
- b. Intended audience
- c. Location of training
- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)
- i. Instructor names and instructor qualifications for each subject

- j. List of texts and other materials to be furnished by the Contractor that are required to support training
- k. Description of proposed software to be used for video recording of training sessions.

### 3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The CxC is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

### 3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

### 3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

### 3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing,

to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

#### 3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

#### 3.1.7 Quality Control Coordination

Coordinate this training with the CxC in accordance with Section 01 45 00.0 0 10 QUALITY CONTROL.

-- End of Section --



SECTION 01 78 24.00 10

FACILITY DATA REQUIREMENTS

05/18, CHG 1: 11/21

PART 1 GENERAL

This specification requires the collection, organization, and turnover of electronic Facility Data for specific assets designed and constructed as part of this contract. Provide a Facility Document Set (FDS) and Facility Data Workbook (FDW) as defined in this specification. See Sections 01 33 00 SUBMITTAL PROCEDURES, 01 78 00 CLOSEOUT SUBMITTALS, and 01 78 23 OPERATION AND MAINTENANCE DATA, and 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) for additional Facility Data delivery requirements.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 19005-3

(2012) Document Management -- Electronic Document File Format for Long-Term Preservation -- Part 3: Use of ISO 32000-1 with Support for Embedded Files (PDF/A-3)

ISO 32000-1

(2008) Document Management -- Portable Document Format -- Part 1: PDF 1.7

1.2 DEFINITIONS AND ABBREVIATIONS

1.2.1 Assets

Assets are specific items of property or equipment.

1.2.2 Attributes

Attributes are individual pieces of Facility Data that describe facilities and their associated assets.

1.2.3 Facility Data

Information defined and collected in the Facility Data Workbook (FDW) and Facility Document Set (FDS).

1.2.4 Facility Document Set (FDS)

An electronically compiled and organized document containing the supporting documents and data used to populate the Facility Data Workbook during its respective phase of development.

- a. For design-based deliverables, the FDS contains the "Design Complete" or "Issued for Construction" (IFC) design drawings, specifications, and design analysis.
- b. For construction-based deliverables, the FDS is comprised of the

project Operation and Maintenance Data Packages and Government-Approved Record drawings.

#### 1.2.5 Facility Data Workbook (FDW)

A pre-formatted spreadsheet template used to compile Asset, Attribute, Facility, and Space Data that the Government wishes to manage via electronic means. The FDW also contains all requirements associated with proper collection, organization, and turnover of the Facility Data.

#### 1.2.6 Facility Data Project Execution Plan (FDPxP)

A document that describes the clear and organized plan for the collection, organization, and turnover of the Facility Data deliverables required by this specification.

### 1.3 UNITS OF MEASURE

Provide Facility Data deliverables utilizing the units of measure required by 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD).

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Facility Data Project Execution Plan(FDPxP)

#### SD-05 Design Data

Facility Data Workbook, Design; G

Facility Document Set, Design; G

#### SD-10 Operation and Maintenance Data

Facility Data Workbook, Construction Progress; G

Facility Document Set, Construction Progress; G

#### SD-11 Closeout Submittals

Facility Data Workbook, Construction Final; G

Facility Document Set, Construction Final; G

### 1.5 QUALITY CONTROL

#### 1.5.1 Facility Data Project Execution Plan (FDPxP)

Provide the Government with a plan for the collection, organization, and turnover of the Facility Data deliverables to the Government. At a minimum, include the following items in the FDPxP:

1.5.1.1 Front Matter

Provide a Cover Page, Table of Contents, and Executive Summary/Objectives.

1.5.1.2 Project Information

List the Project Owner, Project Name, Project Location and address, Contract Type, Project Description, Project/Contract Number, Project Milestones.

1.5.1.3 Submittal Schedule

Identify delivery schedule for all deliverables in compliance with the submission requirements identified in this specification.

1.5.1.4 Personnel

Identify key personnel involved in the development of the Facility Data deliverables including Contractor and Government personnel.

1.5.1.5 Facility Data Workbook(s)

Identify Facility and Space Data as applicable at time of FDPxP submission. Individually list every asset group from the FDW Requirements that will require Facility Data collection. No attribute data is required at this time. Identify asset groups from the FDW Requirements that are not required within the scope of this Contract. Document the version of FDW to be used through the duration of the project.

1.5.1.6 Facility Document Set(s)

Define structure and format of the submittal. Provide a comprehensive outline of the final FDS to be delivered. Organize the outline with headings, titles, and descriptions such that the Government may ascertain that working documents comply with the formatting requirements defined by this specification.

1.5.1.7 Protocols

Detailed procedures:

- a. Facility Data documentation/collection process.
- b. Facility Document Set production/development process.
- c. Collaboration procedures including strategy, meetings, communication, and subcontractor/consultant involvement.
- d. Quality Control, including site verification of FDW, as applicable.
- e. File and folder naming structure.
- f. Hardware and software being used for collection and organization of Facility Data. Identify type, format, and anticipated organization of digital storage media to be provided as part of required deliverables. Include means and methods for checking deliverables for malicious content.

### 1.5.2 Meetings

To assure that Facility Data requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

#### 1.5.2.1 Post-Award Kickoff Meeting

At a minimum, discuss the following:

- a. The requirement for Facility Data deliverables under this contract.
- b. Primary roles and responsibilities associated with the development and delivery of the Facility Data deliverables, and.
- c. Identify and agree upon a date and attendance list for the meetings described below:

#### 1.5.2.2 FDPxP Coordination Meeting

- a. Facilitate a meeting following submission and Government review of the FDPxP. Include the Facility Data Preparer(s), Designer of Record (DOR), Quality Control (QC) Manager, Commissioning Authority (CA), Government's Facility Data Proponent, Contracting Officer's Representative, and Directorate of Public Works (DPW) Facilities Management Specialist (FMS). Also include Government personnel required for obtaining security clearances and waivers for proper Facility Data collection in this meeting.
- b. The purpose of this meeting is to coordinate the efforts necessary by contract parties to ensure an accurate collection, preparation, quality control, and submittal of these deliverables.
- c. The FDPxP serves as the primary agenda for this meeting. At a minimum, discuss the following:
  - (1) Processes and methods of gathering facility data during construction. Discuss and obtain special permissions and waivers as necessary (such as photo waivers and data encryption);
  - (2) Contractor Quality Control practices and procedures;
  - (3) Corrective actions necessary for Government approval of FDPxP;
  - (4) Necessity for additional or recurring Facility Data Coordination Meetings outside of those required by this specification, as requested by the Contractor. Intent of these meetings would be to maintain regular contact between responsible parties of the Contractor and Government with regard to development of the facility data deliverables. Conduct status meetings with a frequency agreed upon at this meeting.

#### 1.5.2.3 Submittal Coordination Meeting

- a. Facilitate a meeting following submission and Government review of each design or progress submittal of the Facility Data. Include the Facility Data Preparer(s), Designer of Record (DOR), Quality Control (QC) Manager, Commissioning Authority (CA), Government's Facility Data Proponent, Contracting Officer's Representative, and Directorate of

Public Works (DPW) Facilities Management Specialist (FMS). Include Mechanical, Electrical, Plumbing, and Fire Protection subcontractors as applicable.

- b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification.
- c. The applicable deliverables, along with Government remarks associated with review of these submittals serve as the primary guide and agenda for this meeting. At a minimum, discuss the following during this meeting:
  - (1) Review assets, applicable attributes, facility, and space data in FDW at time of submittal;
  - (2) Demonstrate Quality Control and site verification procedures, as applicable, by Contractor QC;
  - (3) Review contents and organization of FDS at time of submittal;
  - (4) Discuss Government review comments and unresolved items preventing completion and Government approval of the Facility Data Workbook and Facility Document Set.

#### 1.5.3 Facility Turnover and Contract Closeout

Include the Facility Document Set, Construction Final as a deliverable in Facility Turnover and Contract Closeout procedures as defined in 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) and 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.5.4 Facility Data Workbook Quality Requirements

For each submittal, ensure that the information contained in the FDW(s) reflects the minimum content requirements defined in the PART 3 EXECUTION portion of this section. Ensure that information provided as part of the FDW(s) conforms to the standards described below:

- a. Compile FDW(s) using approved spreadsheet templates. Do not alter the formatting or organizational layout of the templates. For this Contract, templates are available for download from the USACE CAD/BIM Technology Center website, site information provided in the PART 2 PRODUCTS portion of this section.
- b. Instructions for the proper maintenance and completion of these FDWs are contained in the FDW Requirements contained within the FDW template.

#### 1.5.5 Facility Document Set Quality Requirements

Ensure that information provided as part of each FDS conforms to the electronic and data formatting standards identified in 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) and below:

##### 1.5.5.1 Document Files

Utilize PDF file format in accordance with ISO 32000-1 and ISO 19005-3 for all document-based files. Provide files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution.

## Repair Steam Sterilization Plant (SSP)

Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section.

### 1.5.5.2 Photograph Files

If photographs are required, utilize JPEG file format for all photograph and image files. Provide full-color photos with photo resolution of not less than 4 megapixels and not more than 12 megapixels.

Provide a copy of installation-specific letters or waivers allowing permission to take installed equipment photographs on this Contract. Waivers need not be attached to every photo, only one copy of each permission letter need be included in the Government deliverables.

### 1.5.5.3 Drawing Files

Provide all drawings required by this specification in full-size PDF format in accordance with ISO 32000-1 and ISO 19005-3. Produce PDF files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution whenever possible. Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section.

Submission of scanned or photocopied drawing files is prohibited. Only vector-preserved PDF files are acceptable.

### 1.5.6 Facility Document Set Integrity Requirements

Ensure that information provided as part of each FDS conforms to the integrity standards identified below:

#### 1.5.6.1 File Protection

Do not restrict data files, document files or photographic files from being printed, exported, modified or copied. Do not deliver files with restrictions such as expiration date and locks for access, viewing, archiving, or editing.

#### 1.5.6.2 Manufacturer-Specific Documents

Provide text-searchable, vector-based document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same file. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver facility data submittals in an organized and legible manner. Provide submittals adhering to the requirements of 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD) and described below.

### 1.6.1 Number of Copies

Provide three identical copies of disks for approval; for each submittal and each facility required. Provide on approved electronic media (one copy per disk or set of disks) as defined below. Provide submittal files on

electronic storage media in compliance with the quality requirements identified in this specification.

#### 1.6.2 Malicious Content

Scan all files for malicious viruses using a commercially available scanning program that is routinely updated to identify and remove current virus threats.

#### 1.6.3 Storage Media

Provide facility data on disk-based (DVD-R/RW) media. Deviations from the required storage media must be approved by the Government. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Further divisions must be documented in the FDPxP and approved by the Government.

Provide Facility Data on disk-based (DVD-R/RW) media. Deviations from the required storage media must be approved by the Government. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Further divisions must be documented in the FDPxP and approved by the Government.

- a. Apply a label directly printed to storage media. Do not provide adhesive, paper-based labels. List the name of the facility, Project, Project location, Contract number, Designer of Record firm/Prime Contractor company's name, title of submission, and security classification (in accordance with the appropriate security classification labeling regulations) on the label. If multiple disks are provided, clearly document the contents of each disk on the label.
- b. Include the name and contact information of the individual who produced the final data disk to ensure that problems with the data or media can be easily resolved.
- c. When browsed on a computer, the disk must display the following folders and their associated content:
  - (1) Facility Data Workbook (containing 1 FDW per facility);
  - (2) Facility Document Set (containing 1 FDS per facility);
  - (3) FDPxP (containing 1 PxP per contract);
  - (4) Readme (Containing 1 TXT, PDF, or HTML file with general use information, organizational instructions, and basic preparer contact information. Include all information included on the storage media label).

#### 1.6.4 Encryption

Encrypt deliverable data as directed by Resident Office Engineer. Document the encryption to be used in the FDPxP.

## PART 2 PRODUCTS

### 2.1 FACILITIES

Facilities that require individual (separate and complete) Facility Data deliverables as described in this specification are as follows:

- a. USAMRIID Building 8100.

### 2.2 FACILITY DATA WORKBOOK(S)

Provide one compiled FDW for each facility identified above. Complete all portions of each FDW including facility, space, asset, and attribute data in compliance with the FDW Requirements. Download the current FDW template (.xlsm format) from the USACE CAD/BIM Technology Center website at <https://cadbimcenter.erd.c.dren.mil>.

#### 2.2.1 Spaces

Provide data for all applicable spaces in the facility. Minimum space definitions are as follows:

- a. Provide all rooms as defined in the design documents.
- b. If not otherwise defined, provide a minimum of one "roof" space in the FDW.
- c. If not otherwise defined, provide a minimum of one "site" space in the FDW.
- d. Provide all spaces not otherwise described, but necessary to accurately indicate the location of all FDW assets required by this specification.

#### 2.2.2 Assets

- a. Compile an FDW that contains all applicable asset types described in the "Required Assets" portion of the FDW template and any additional assets defined in the FDPxP, maintainable and warrantable equipment (assets) associated with each facility. This includes assets in contract scope and within the project extents. See 01 78 00 CLOSEOUT SUBMITTALS for related requirements. Assets include, but are not limited to, those types described in the "Required Assets" portion of the FDW template and additional assets defined in the FDPxP. Itemized FDW asset entries (instance-based). Entries indicative of multiple assets (type-based) are not allowed.

Document assets applicable to the scope of this project in the FDPxP.

- b. Sub-component assets that are an integral and functional part of another component (e.g. An electric motor that serves as part of an air-handling unit) need not be duplicated or listed separately as its own asset.
- c. Definitions, descriptions, and formatting requirements for these assets can be found in the FDW Requirements contained within the FDW template.
- d. If an asset type is not included in the scope of the Project, no Facility Data (assets or attributes) are to be included in the FDW (even as a placeholder) for that asset type.



### 2.2.3 Attributes

- a. Populate each individual asset with all required attributes defined in the "Required Attributes" portion of the FDW template.
- b. Definitions, descriptions, and formatting requirements for these attributes can be found in the FDW Requirements contained within the FDW template.
- c. If an attribute is not applicable, populate that field with "N/A." Do not leave it blank.

## 2.3 FACILITY DOCUMENT SET

### 2.3.1 Organization

Organize the FDS in a hierarchical manner as follows. Use electronic bookmarks to create an easily navigable document. The first and primary hierarchical level must contain the following bookmarks:

- a. "Design Data" - See subordinate hierarchical requirements in the "DESIGN DATA HIERARCHY" paragraph.
- b. "O&M Data" - See subordinate hierarchical requirements in the "O&M DATA HIERARCHY" paragraph.
- c. "Record Drawings" - See subordinate hierarchical requirements in paragraph RECORD DRAWINGS HIERARCHY.

#### 2.3.1.1 Design Data Hierarchy

Under "Design Data," provide all Government-Approved "Design Complete" or "Issued for Construction" design documents as defined in 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD), including:

- a. Design Drawings - Provide the Government-Approved, "Design Complete" or "Issued for Construction" design drawings.
- b. Design Specifications - Provide the Government-Approved, "Design Complete" or "Issued for Construction" design specifications.
- c. Design Analysis - Provide the "Design Complete" or "Issued for Construction" Government-Approved Design Analysis.

#### 2.3.1.2 O&M Data Hierarchy

Under "O&M Data" provide all Government-Approved O&M Data Packages as defined in 01 78 23 OPERATION AND MAINTENANCE DATA and as required by technical specifications contained within this contract. Further organize this information under the following hierarchical levels:

- a. The contract specification and title under which the Data Package and the associated equipment or system references. (e.g. 26 23 00.00 40 - SWITCHBOARDS AND SWITCHGEAR)
- b. The Data Package Number as defined in 01 78 23 OPERATION AND MAINTENANCE DATA. (e.g. Data Package 2)

### 2.3.1.3 Record Drawings Hierarchy

Under "Record Drawings" provide an electronic copy of the Government-Approved record drawings, as specified in 01 78 00 CLOSEOUT SUBMITTALS, for the project in PDF format. Further group discipline sheets under the following hierarchical levels:

- a. The full discipline heading represented by the contents of the sheet and as shown in the Record Drawing Sheet Index. Organize these headings in the order that the drawings set is organized. (General, Civil, Structural, Architectural, Interiors, Plumbing, Mechanical, Electrical, Telecommunications)
- b. The Sheet ID and Sheet Name as found in the Record Drawing Sheet Index and in accordance with the AEC CAD Standard referenced in 01 78 00 CLOSEOUT SUBMITTALS. (e.g. G-001 - LEGEND; CS101 - SITE PLAN AREA 101; A-101 - OVERALL FIRST FLOOR PLAN; P-601 - FIRST FLOOR DWS WATER RISER DIAGRAM)

## PART 3 EXECUTION

### 3.1 DESIGN SUBMITTALS

Submit the Facility Data Workbook and Facility Document Set design submittals together. Meet the following completeness and formatting requirements listed below:

- a. Provide Facility Data Workbook, Design submittals(s) when at "Design Complete" or "Issued for Construction" phase as defined by 01 33 16.00 10 DESIGN DATA (DESIGN AFTER AWARD). Populate the FDW with all data required for the design submittal, detailed in the FDW Requirements. Clearly identify assets or asset groups missing in the "variations" section of the ENG Form 4025 Transmittal Form provided with the submittal. See the FDW Requirements contained within the FDW template for a list of attributes to be completed for this submittal. Intent of this submittal is to populate the FDW with all design-based asset information prior to Project advertisement or construction.
- b. Submit individual FDW templates for each facility identified in the "FACILITIES" paragraph. While FDWs will not be complete at this phase, provide accurate and correctly formatted data according to the FDW Requirements.
- c. Submit Facility Document Set, Design submittal as defined in Part 2 of this specification.

### 3.2 CONSTRUCTION PROGRESS SUBMITTALS

Submit the FDW and FDS construction progress submittals together. Meet the following completeness and formatting requirements listed below:

- a. Provide Facility Data Workbook, Construction Progress submittal(s) when all assets are identified, but not later than 90 days prior to Beneficial Occupancy Date (BOD) as identified in the Government-Approved construction schedule. Clearly identify assets or asset groups missing in the "variations" section of the ENG Form 4025 Transmittal Form provided with the submittal. Populate assets with front-loaded attribute data that is available at the time of asset

input. See the FDW Requirements contained within the FDW template for a list of attributes to be completed for this submittal.

- b. Submit individual FDW templates for each facility identified in the "FACILITIES" paragraph. While FDWs are not required to be complete for this submittal, provide accurate and correctly formatted data according to the FDW Requirements.
- c. Submit a sample or working Facility Document Set, Construction Progress submittal containing "draft" or "example" documents that are organized in the manner defined by this specification. Draft or example documents need not be technically accurate or complete in their content, but defined and separated in a manner such that all organizational and formatting requirements defined by this specification may be evaluated.

### 3.3 CONSTRUCTION FINAL SUBMITTALS

Submit the FDW and FDS construction final submittals as they are completed. Coordinate the Facility Data Workbook, Construction Final submittal with data verification procedures as defined in the accepted FDPxP. Provide the Facility Document Set, Construction Final submittal only after Government acceptance of its individual components as defined by 01 78 00 CLOSEOUT SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA.

### 3.4 FACILITY DATA WORKBOOK VERIFICATION

Verify the FDW through the quality control personnel and procedures as defined in the FDPxP. Coordinate and conduct verification with commissioning procedures defined in Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING. One-hundred percent accuracy of FDW information is required for Government acceptance of the Facility Data Workbook, Design submittal and Facility Data Workbook, Construction Final submittal.

-- End of Section --

SECTION 01 91 00.15 10

TOTAL BUILDING COMMISSIONING  
05/19, CHG 2: 08/20

PART 1 GENERAL

1.1 SUMMARY

Commission the building systems listed herein. Employ the services of an independent Commissioning Firm. The Commissioning Firm must be a 1st tier subcontractor of the General or Prime Contractor and must be financially and corporately independent of all other subcontractors. The Commissioning Firm must employ a Lead Commissioning Specialist that coordinates all aspects of the commissioning process. Conform to the commissioning procedures outlined in this specification.

1.2 UNIFIED FACILITIES GUIDE SPECIFICATION REFERENCES

This specification section is intended to work in conjunction with the requirements included in the Unified Facilities Guide Specifications (UFGS) referenced within this specification section. Comply with the requirements of the referenced UFGS to the extent specified herein. UFGS can be found at on the Whole Building Design Guide website at: <http://www.wbdg.org/>

1.3 SYSTEMS TO BE COMMISSIONED

Commission the following systems:

Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC)  
Building Automation System  
Industrial Monitoring and Control System (ICS)controlling the EDS  
Lighting Systems  
Power Distribution Systems  
Effluent Decontamination Systems (EDS) including Cybersecurity of associated ICS  
Plumbing Systems  
Fire Alarm Extensions to existing system  
Fire Suppression System extensions to existing system  
Security System Extensions to existing systems

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 180 (2012) Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems

ASHRAE 202 (2018) Commissioning Process for Buildings

and Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline (2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard (2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 014 (2013) HVAC Systems Commissioning Manual, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 25-345-1 (2019) Systems Manual

1.5 COMMUNICATION WITH THE GOVERNMENT

The Lead Commissioning Specialist (CxC) must submit all plans, schedules, reports, and documentation directly to the Contracting Officer Representative concurrent with submission to the CQC System Manager. The Lead Commissioning Specialist must have direct communication with the Contracting Officer's Representative regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Lead Commissioning Specialist.

1.6 SEQUENCING AND SCHEDULING

1.6.1 Sequencing

Complete the following prior to starting Functional Performance Tests of mechanical systems:

- a. All equipment and systems have been completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.
- b. Performance Verification Tests of the controls systems have been completed and the Performance Verification Test Report has been submitted and approved in accordance with UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
- c. Testing, Adjusting, and Balancing has been completed and the Testing, Adjusting, and Balancing Report, has been submitted and approved in accordance with UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- d. The Pre-Functional Checklists have been submitted and approved.
- e. The Certificate of Readiness for mechanical systems has been submitted and approved.

Complete the following prior to starting Functional Performance Tests of

the electrical systems:

- a. All electrical and lighting equipment and systems have been completed, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.
- b. The Certificate of Readiness for electrical systems has been submitted and approved.
- c. Lamps have completed a minimum 100 hour burn-in period.

Complete the following prior to starting Functional Performance Tests of the Fire Alarm systems:

- a. New Fire Alarm Panels and devices have been have been completed, tested, and operate in accordance with contract documents and construction plans and specifications.
- b. The Certificate of Readiness for electrical systems has been submitted and approved.

Complete the following prior to starting Functional Performance Tests of the Security systems:

- a. New Security Panels, cameras, and access control devices have been have been completed, tested, and operate in accordance with contract documents and construction plans and specifications.
- b. The Certificate of Readiness for electrical systems has been submitted and approved.

#### 1.6.2 Project Schedule

Include the following tasks in the project schedule required by Section 01 32 01.00 10 PROJECT SCHEDULE. Ensure sufficient time is scheduled to accommodate the requirements of this specification section. The order of items listed below is not intended to imply a specified sequence:

- a. Submission and approval of the Commissioning Firm and Commissioning Specialist
- b. Submission and approval of the Testing, Adjusting, and Balancing (TAB) Firm and TAB Specialist specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- c. Submission of the Design Review Report specified herein.
- d. Submission of the Design Review Report specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- e. Submission and approval of the Construction Phase Commissioning Plan
- f. Installation of permanent utilities (water, electric)
- g. Completion of pipe weld inspection and non-destructive pipe weld testing

Repair Steam Sterilization Plant (SSP)

- h. Drainage and Vent, Water Supply Systems and Backflow Prevention Assembly Tests specified in UFGS Section 22 00 00 PLUMBING, GENERAL PURPOSE
- i. Factory Acceptance Testing for each of the systems to be commissioned as required by technical specifications
- j. Manufacturer's Equipment Start-Up for each of the systems to be commissioned.
- k. Potable Water System Flushing specified in UFGS Section 22 00 00 PLUMBING, GENERAL PURPOSE
- l. Operational Tests of the plumbing system specified in UFGS Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- m. Potable Water System Disinfection specified in UFGS Section 22 00 00 PLUMBING, GENERAL PURPOSE
- n. Submission and approval of the TAB Schematic Drawings, Report Forms, and Procedures specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- o. Submission and approval of Duct Air Leakage Test Procedures specified in UFGS Section 23 55 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- p. Duct Air Leakage Test Execution specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- q. Submission and approval of the Final Duct Air Leakage Test Report specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- r. Testing, Adjusting, and Balancing (TAB) Field Work required by UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- s. Submission and approval of the TAB Report specified in UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- t. TAB Field Acceptance Testing required by UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- u. Submission and approval of the Start-Up Testing Report specified in UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
- v. Submission and approval of the Performance Verification Test Procedures specified in UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
- w. Performance Verification Tests required by UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC
- x. Performance Verification Test Report specified in UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC
- y. Pre-Functional Checklist Submittal
- z. Functional Performance Testing for each system to be commissioned

## Repair Steam Sterilization Plant (SSP)

- aa. Integrated Systems Tests
- bb. Post-Test Deficiency Correction for each system to be commissioned
- cc. Re-Testing
- dd. Training for each of the systems to be commissioned
- ee. Systems Manual, Maintenance Plan, and Service Life Plan submission and approval
- ff. Submission and approval of the Commissioning Report
- gg. Seasonal Testing
- hh. Post-Construction Endurance Testing
- ii. Post-Construction Site Visit

### 1.7 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

- Commissioning Firm; G, DO
- Lead Commissioning Specialist; G, DO
- Technical Commissioning Specialists; G, DO
- Commissioning Firm's Contract; G, DO

#### SD-05 Design Data

- Design Phase Commissioning Plan; G, DO

#### SD-06 Test Reports

- Design Review Report; G, DO
- Interim Construction Phase Commissioning Plan; G, DO
- Final Construction Phase Commissioning Plan; G, DO
- Factory Acceptance Test Scripts; G, DO
- Factory Acceptance Test Reports; G, DO
- Pre-Functional Checklists; G, DO
- Issues Log
- Commissioning Report; G, DO



Post-Construction Trend Log Report; G, DO

SD-07 Certificates

Certificate of Readiness; G, DO

SD-10 Operation and Maintenance Data

Training Plan; G, RO

Training Attendance Rosters; G, RO

Systems Manual; G, DO

Maintenance and Service Life Plans; G, DO

SD-11 Closeout Submittals

Final Commissioning Report; S, DO

Final Construction Phase Commissioning Plan; S

1.8 COMMISSIONING FIRM

Provide a Commissioning Firm that is certified in commissioning by one of the following: the AABC Commissioning Group (ACG); the National Environmental Balancing Bureau (NEBB); the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB), the Building Commissioning Association (BCA); the Association of Energy Engineers (AEE).

The Commissioning Firm may employ a commissioning professional certified by the University of Wisconsin-Madison or the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) as required in paragraph LEAD COMMISSIONING SPECIALIST as an alternative to certification of the Commissioning Firm. The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning.

- a. Submit the Commissioning Firm's certification of qualifications including the name of the firm and certifications no later than 60 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.
- b. The Commissioning Firm's and Commissioning Specialists' certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the firm or a specialist loses a certification during this period, immediately notify the Contracting Officer's Representative and submit another Commissioning Firm or Commissioning Specialist for approval. All work specified in this specification section performed by the Commissioning Firm or associated Commissioning Specialists is invalid if the Commissioning Firm or Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

- c. The Commissioning Firm must oversee and assist the General or Prime Contractor with the work specified herein. Submit the Commissioning Firm's Contract including the Scope of Work associated with the paragraph POST-CONSTRUCTION SUPPORT no later than 60 calendar days after approval of the Commissioning Firm. Submit one hard copy and an electronic copy.

#### 1.8.1 Lead Commissioning Specialist

The Commissioning Firm must provide a Lead Commissioning Specialist (CxC) that has a minimum of five years of commissioning experience, including two projects of similar size and complexity, and that is one of the following: a NEBB qualified Systems Commissioning Administrator (SCA); ACG Certified Commissioning Authority (CxA); ICB/TABB Certified Commissioning Supervisor; BCA Certified Commissioning Professional (CCP); AEE Certified Building Commissioning Professional (CBCP); University of Wisconsin-Madison Qualified Commissioning Process Provider (QCxP); Building Commissioning Professional (BCxP).

- a. Submit the Lead Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 60 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.
- b. The Lead Commissioning Specialists certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the specialist loses a certification during this period, immediately notify the Contracting Officer's Representative and submit another Lead Commissioning Specialist for approval. All work specified in this specification section to be performed by the Lead Commissioning Specialist is invalid if the Lead Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.
- c. The Lead Commissioning Specialist must lead and oversee the commissioning work specified herein and be the primary point of contact for the Government regarding the commissioning work. One of the Technical Commissioning Specialists may be the Lead Commissioning Specialist provided that all of the qualification requirements are met.

#### 1.8.2 Technical Commissioning Specialists

Technical Commissioning Specialists, employed by the Commissioning Firm and that have the following qualifications, must perform the technical work specified herein associated with each system to be commissioned:

- a. Mechanical Technical Commissioning Specialist: The technical work associated with mechanical systems including Heating, Ventilating, Air Conditioning, and Refrigeration Systems; Building Automation System; Utility Monitoring and Control System; Effluent Decontamination Systems; Service Water Heating Systems; Plumbing Systems; Compressed Air and Vacuum Systems; must be performed by a Commissioning Specialist certified by NEBB, ACG, ICB/TABB, or BCA in the commissioning of HVAC systems with five years of experience in the commissioning of HVAC systems.
- b. Electrical Technical Commissioning Specialist: The technical work associated with electrical systems including Lighting Systems; Power

Distribution Systems; must follow Section 26 08 00 Apparatus Inspection and Testing when NETA testing is required.

- c. Submit the Technical Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 60 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.

#### 1.8.3 Commissioning Team Responsibilities

CxC is responsible for the following tasks as part of their scope of work under the DB contract. Some tasks are further detailed below.

1. Develop the design phase commissioning plan.
2. Review the Cx requirements defined in the DB RFP, and if necessary provide the final commissioning specifications using the UFGS and applicable tailoring options during the design phase of the DB process if changes are dictated by USACE. Issue updates to assure alignment with each design phase submission.
3. Author the Cx narrative section of Basis of Design (BOD) narrative.
4. Participate in design reviews associated with each design phase submission to assure the design sufficiently supports the required commissioning of the project. The documents reviewed will include the Owner Project Requirements (OPR), BOD, the design drawings and specifications. CxCommissioning Firm specialists shall attend comment review meetings. The review comments from the CxC shall be documented in Dr. Checks at each design submission, please see 01 33 16.00 10 Design Data (Design After Award) Specification. Note the OPR to review will be that developed by the DB design team based on DD Form 1391 and the design charrette presentation and meeting minutes included in the RFP.
5. Conduct design phase commissioning meetings, including a design phase Cx kickoff and progress meetings, one per design submission.
6. Refine Using the representative testing documents included in the DB RFP and produce the final testing documents/forms for review and approval by USACE.
7. Ensure the factory testing requirements of the construction specifications clearly and thoroughly stipulate the requirements and acceptance criteria of the factory acceptance tests required.
8. Define the durations and the logic of the commissioning tasks within the contractor's overall construction schedule.
9. Develop the prefunctional checklists and review performance verification test forms (per specification section 23 09 00 to be provided by 23 09 00 contractor) which shall be completed by the applicable contractors during the QC and prefunctional activities. The level of detail shall meet the examples provided in this RFP at a minimum. The examples do not dictate format and CxC may submit their preferred format for approval.
10. Develop the construction phase commissioning plan.

11. Develop the CxCommissioning Firm/CxC Safety Plan and coordinate protocols with the Prime DB safety protocols.
12. Conduct construction phase commissioning progress meetings starting with the construction phase Cx kickoff meeting. Progress meeting frequency shall increase as the project moves into the startup phase and again as it moves to the testing phase. At a minimum, meetings up to the beginning of startup activities shall be monthly; be every two weeks until the start of functional testing, and weekly throughout functional testing. On days of functional testing, brief coordination meetings with parties involved in that testing shall be daily.
13. Review contract submittals for equipment included in the Cx scope to assure they conform with the design and UFGS requirements and sufficiently meet the Cx requirements. CxC or the technical specialists shall review and approve submittals prior to the prime contractor submitting those submittals to the Government.
14. Review and approve Factory Acceptance Testing protocols and testing scripts developed by the supplying manufacturer.
15. Develop the final functional performance tests scripts/checklists that dictate the functional test procedures to be executed by the Cx Team. Submit these for approval prior to test execution. Script format and content shall conform to the UFGS standard as detailed in 01 91 00.15 10 and shown on UFGS example templates.
16. Develop and maintain action list or issues log to record issues found and resolved during commissioning.
17. Attend factory installation and QC inspections and acceptance tests.
18. Coordinate with the construction team and MRDC/USAMRIID for establishing the procedures for entering DMLSS data (equipment nameplate and performance data and operation and maintenance procedures)
19. Attend Factory Acceptance Testing or both the EDS and the Penthouse Modular Mechanical system.
20. Review and approve the Factory Acceptance Testing report.
21. Attend and witness representative QC, startup, and prefunctional activities to verify conformance with the Cx requirements.
22. Witness 2550% of non-destructive weld testing of EDS piping, steam and condensate piping, HW and CHW piping, etc. All welded piping systems shall be witnessed. Specify this requirement in the applicable construction specifications.
23. Confirm DMLSS data entry accuracy via inspection of nameplate data and submittal information.
24. Specify the DMLSS data process outlined below in the applicable construction specifications.
25. Witness Testing, Adjusting, and Balancing (TAB) verification.

26. Witness Cybersecurity PVTs on EDS control systems.
27. Assess readiness for functional testing prior to beginning test execution. Review the QC and prefunctional documentation and inspect applicable systems and equipment to confirm readiness. CxC Technical Specialists shall certify reviewed completion of startup reports and PVTs per 01 91 00.15 10.
28. Direct and record the functional testing. CxC and/or their applicable technical specialists shall direct testing and record results. Review associated documentation.
29. Develop the Integrated System tests scripts/checklists that dictate the test procedures to confirm the integrated operation of multiple systems. The scripts/checklists shall be executed by the Cx Team, and directed and recorded by the CxC and/or their applicable technical specialists.
30. Review OM Manuals, Training Plans, Training Records, and warranty data
31. Lead and direct all functional testing integrated systems functional testing, and record all results
32. Develop Systems Manuals for the systems in the Cx scope.
33. Produce the final commissioning report.
34. Lead opposite season testing as applicable. Perform post construction "Endurance Test" in accordance with 01 91 00.15 10 and 23 09 00 as developed during the design phase.

#### 1.8.4 Commissioning Standard

Comply with the requirements of the commissioning standard under which the Commissioning Firm and Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, ASHRAE, or the University of Wisconsin-Madison, comply with the requirements of one of the acceptable standards unless otherwise stated herein. The acceptable standards are ACG Commissioning Guideline, NEBB Commissioning Standard, ANSI/SMACNA 014, or ASHRAE 202. Comply with applicable NETA testing standards for electrical systems.

- a. Implement all recommendations and suggested practices contained in the Commissioning Standard and electrical test standards.
- b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.
- c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.
- d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.
- e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.

- f. Use any new requirements, recommendations, and procedures published or adopted prior to contract solicitation by the body responsible for the Commissioning Standard.

## 1.9 ISSUES LOG

The Lead Commissioning Specialist must develop and maintain an Issues Log for tracking and resolution of all deficiencies discovered through submittal reviews, inspection, and testing. Include the date of final resolution of issues as confirmed by the Commissioning Specialist. Submit the Issues Log on a monthly basis at a minimum. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the Commissioning Specialist for inclusion into the Issues Log.

Track construction deficiencies identified in the Issues Log using QCS as specified in Specification Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

## 1.10 CERTIFICATE OF READINESS

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness for the system certifying that the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; Performance Verification Test Reports; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; HVAC Controls Start-Up Reports to the extent applicable to the system. The Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness. Submit the Certificate of Readiness for each system no later than 14 calendar days prior to Functional Performance Tests of that system. Submit one hard copy and an electronic copy. Do not schedule Functional Performance Tests for a system until the Certificate of Readiness for that system receives approval by the Government.

## PART 2 PRODUCTS

Not used

## PART 3 EXECUTION

### 3.1 DESIGN PHASE

#### 3.1.1 Design Commissioning Coordination Meeting

The Lead Commissioning Specialist (CxC) must lead a meeting prior to the interim design submittal for any system required to be commissioned to discuss the commissioning process including project contract requirements, lines of communication, roles and responsibilities, schedules, and documentation requirements. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, the Designers of Record for the commissioned systems, and the Government must attend this meeting. The User and a Directorate of Public Works Representative, a Reserve Support Command Representative, USAMRIID Facilities, USAMRIID Safety, MRDC/USAMRIID, and DA Safety may attend this meeting.

### 3.1.2 Design Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Design Phase Commissioning Plan and submit it prior to the submission of the initial design submission. Submit the Design Phase Commissioning Plan no later than 14 calendar days after approval of the Commissioning Specialists. Submit one hard copy and an electronic copy.

Outline the commissioning process, commissioning team members and responsibilities, lines of communication, and documentation requirements for the design and construction phase of the project in the Design Phase Commissioning Plan. Identify the Commissioning Standard chosen for the project. In addition, include the following in the Design Phase Commissioning Plan:

- a. Plan purpose
- b. Commissioning scope
- c. Systems to be commissioned
- d. Examples and description of development of pre-functional, integrated systems test, and functional performance test checklists
- e. Building information
- f. Contact information for the Commissioning Specialists
- g. Criteria listing, including Unified Facilities Criteria and building codes and standards, identified by the design-build contract
- h. Roles and responsibilities
- i. Management plan
- j. Owner's Project Requirements Document
- k. Description of the Basis of Design
- l. Description of design reviews by the Commissioning Specialists
- n. Description of site observation reports and the issues log
- o. Listing and description of required meetings
- p. Identification and sequence of commissioning and acceptance tasks for incorporation into the Project Schedule
- q. Listing of required submittals to Government and Commissioning Specialists
- r. Description of execution of pre-functional checks, integrated systems tests, and functional performance tests
- s. Description of Endurance Tests
- t. Acceptance testing of critical systems as identified in contract specifications

- u. Operation and maintenance manual requirements
- v. Description of training requirements
- w. Description of required Systems Manual
- x. Description of the Commissioning Report

### 3.1.3 Design Review

The Lead Commissioning Specialist and Technical Commissioning Specialists must review the design-build construction contract, Design Plans and Specifications, the Basis of Design, and the Owner's Project Requirements Document at each phase submission of the design. The Owner's Project Requirements Document is attached as Appendix A. The Owner's Project Requirements Document is not contract requirements and is provided for commissioning review purposes only. The Commissioning Specialists must assess the completeness and clarity of the Owner's Project Requirements, verify that the requirements stated in the design-build construction contract and the Owner's Project Requirements are addressed in the Basis of Design, and verify that the Design Plans and Specifications are prepared in accordance with the Basis of Design, the design-build construction contract, the Unified Facilities Criteria (UFC) referenced by the design-build construction contract, and the Owner's Project Requirements. The Commissioning Specialists must also identify any deficiencies that would prevent the building systems from operating or performing effectively. The Commissioning Specialists must backcheck the reviewed documents at all subsequent design documentation submissions.

The Commissioning Specialists must provide a Design Review Report for each submittal identifying any discrepancies between the reviewed documents or deficiencies that would prevent the building systems and features from operating or performing effectively in accordance with the design-build construction contract and Owner's Project Requirements Document and from being adequately maintainable. Individually list each deficiency and the corresponding proposed corrective action necessary for proper system performance in the Design Review Report. Submit one hard copy and an electronic copy of the report with the corrected final design submission. The Contracting Officer's Representative, the Lead Commissioning Specialist, and the Designers of Record for the associated systems must meet, discuss, and resolve any outstanding items contained in the report no later than 14 calendar days after submission of the report.

## 3.2 CONSTRUCTION PHASE

### 3.2.1 Construction Commissioning Coordination Meetings

The Lead Commissioning Specialist must lead a Construction Commissioning Coordination Meeting no later than 30 days following construction notice to proceed to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this specification section. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, and the Government must attend this meeting. Invite the User, USAMRIID Facilities, USAMRIID Safety, MRDC/USAMRIID, and DA Safety to attend this meeting. The Lead Commissioning Specialist must then lead regular commissioning coordination meetings. Meetings shall be at a



minimum monthly during initial construction phase. Meetings shall be every two weeks once the EDS vendor begins startup of the EDS system. Meetings shall be every week during execution of functional performance tests.

### 3.2.2 Construction Phase Commissioning Plan

#### 3.2.2.1 Interim Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Interim Construction Phase Commissioning Plan. Submit the Interim Construction Phase Commissioning Plan no later than 30 calendar days after the Construction Commissioning Coordination Meeting and no later than 14 days prior to the start of construction of the building envelope. Submit one hard copy and an electronic copy.

Identify the commissioning and testing standards and outline the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, documentation requirements for the construction phase of the project in the Interim Construction Phase Commissioning Plan.

##### 3.2.2.1.1 Checklists

PFCs and FPTs shall be created by the CxC and shall reflect project specific details and equipment. Checklists shall not include items such as N/A (not applicable) or B/O (by others). PFCs shall be created for each individual type of equipment and each system required to be commissioned, i.e. ductwork, piping, controls, equipment, etc. The PFCs shall have a section for each line item to be initialed by the subcontractor. In addition, the PFCs shall have a signature page and include an area for the subcontractor's signatures, Contractor's QC and CxC Specialist. The checklists submitted in the Interim and Final Construction Phase Commissioning Plans must contain the same level of detail shown in the examples in the Design Build RFP. The submitted checklists are not required to match the format of the examples.

#### 3.2.2.2 Final Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Final Construction Phase Commissioning Plan. Submit the Final Construction Phase Commissioning Plan no later than 30 calendar days prior to the start of Pre-Functional Checks. Submit one hard copy and an electronic copy. Once approved, file the approved plan in the Sustainability eNotebook.

Include the information provided in the Interim Construction Phase Commissioning Plan. In addition, the Technical Commissioning Specialist must develop the Pre-Functional Checklists, Integrated Systems Test Checklists, and Functional Performance Test Checklists for each building, for each system required to be commissioned, and for each component for inclusion in the Final Construction Phase Commissioning Plan.

##### 3.2.2.2.1 Pre-Functional Checklists

The Pre-Functional Checklists must include items for physical inspection or testing that demonstrate that installation and start-up of equipment and systems is complete. Refer to paragraph Pre-Functional Checks for more information.

#### 3.2.2.2.2 Functional Performance Test Checklists

Functional Performance Test Checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. Refer to paragraph Functional Performance and Integrated Systems Tests for more information. Include the following sections and details appropriate to the systems being tested in the Functional Performance Test Checklists:

- a. Notable system features including information about controls to facilitate understanding of system operation
- b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be accepted by the Government.
- c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions
- d. Attendees
- e. Identification of the equipment involved in the test
- f. Control system feature identification
- g. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator work station
- h. Actuator operation observations demonstrating actuator responses to commands from the control system
- i. As-found condition of the system operation
- j. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.
- k. Space for comments for each test item.

#### 3.2.2.2.3 Integrated Systems Test Checklists

Integrated Systems Test Checklists must include test procedures that explain, step-by-step, the actions and expected results that will demonstrate that the interactive operations between systems performs in accordance with the contract. Refer to paragraph Functional Performance and Integrated Systems Tests for more information. Include the following sections in the Integrated Systems Test Checklists:

- a. Notable features of the interconnected systems organized by discipline including information to facilitate understanding of system operation
- b. Conclusions and recommendations. Conclusions must clearly indicate if the systems do or do not perform in accordance with contract requirements. Recommendation must clearly indicate that the systems should or should not be accepted by the Government

- c. Test conditions including date and beginning and ending time
- d. Attendees
- e. Identification of the equipment and systems involved in the test
- f. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.
- g. Space for comments for each test item.

### 3.2.3 Construction Submittals

Provide all submittals associated with the systems to be commissioned, including shop drawings; equipment submittals; test plans, procedures, and reports; and resubmittal's to the Commissioning Specialists. The Technical Commissioning Specialist must review the submittals to the extent necessary verify that the equipment and system installation will comply with the contract requirements, the Unified Facilities Criteria (UFC) referenced by the design-build contract, and the requirements of the Basis of Design and the Owner's Project Requirements Document. An excel document of the project's submittal register shall be used to designate which submittals are for CxC review and this document shall be submitted to the government for review as part of the Interim Construction Phase Cx Plan.

### 3.2.4 Factory Acceptance Testing

Factory Acceptance Testing is specified in the relevant EDS technical specifications. EDS Manufacturer shall submit written plans and test scripts for the tests at the factory and submit them for review. Effluent Decontamination System Technical Specialist along with Designer of Record, USAMRIID Facilities Representative, USAMRIID Safety Representative, and MRDC Representative shall review the Factory Acceptance Testing Plan and Script and provide comments until all are addressed and finally approved. Ensure acceptance criteria is clearly stated and ultimately that the criteria is met. EDS Commissioning Specialist and Designer of Record shall witness all tests and sign-off on witnessed test results. EDS Commissioning Specialist shall record any issues in the Commissioning Issues Log. EDS Commissioning Specialist shall review final Factory Acceptance Testing Results and reports provided by the EDS Manufacturer and include in the Commissioning Report.

### 3.2.5 Inspection and Testing

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents and the Owner's Project Requirements. Requirements in related specification sections are independent from the requirements of this section and do not satisfy any of the requirements specified in this specification section. Provide all materials, services, and labor required to perform the Pre-Functional Checks, Integrated Systems Tests, and Functional Performance Tests.

#### 3.2.5.1 Commissioning Team

Provide a commissioning representative for each sub-contractor associated

## Repair Steam Sterilization Plant (SSP)

with the systems to be commissioned. Each commissioning representative is responsible for coordination of their respective sub-contractor's execution of the commissioning activities and participation in the inspection and testing required by this specification section. The designers listed below are the designers of record for their respective systems. Substitutes must be approved by the Contracting Officer's Representative.

### 3.2.5.1.1 Mechanical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of mechanical systems (HVAC, Plumbing and Fire Suppression):

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative

### 3.2.5.1.2 EDS System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of Effluent Decontamination Systems (including Cybersecurity PVTs):

Designation	Function
CxED	Effluent Decontamination System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EDSV	EDS Vendor Representative
EC	Contractor's Electrical Commissioning Representative
EDS-CC	Effluent Decontamination System Vendor Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative

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Designation	Function
PC	Contractor's Plumbing Commissioning Representative

### 3.2.5.1.3 Electrical and Fire Protection System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of electrical systems:

Designation	Function
CxE	Electrical System Technical Commissioning Specialist
CxFA	Fire Alarm System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative
FAC	Contractor's Fire Alarm System Commissioning Representative

### 3.2.5.1.4 Security System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of electrical systems:

Designation	Function
CxSS	Security System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
SSC	Contractor's Security Commissioning Representative

### 3.2.5.1.5 Mechanical Systems Test Team

The following team members must participate in Functional Performance, Seasonal, and Integrated Systems Testing of mechanical systems (HVAC, Plumbing, and Fire Suppression):

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist

## Repair Steam Sterilization Plant (SSP)

Designation	Function
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative

### 3.2.5.1.6 EDS System Pre-Functional Checks Team

The following team members must participate in Functional Performance, Seasonal, and Integrated Systems Testing of Effluent Decontamination Systems:

Designation	Function
CxED	Effluent Decontamination System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EDSV	EDS Vendor Representative
EC	Contractor's Electrical Commissioning Representative
EDS-CC	Effluent Decontamination System Vendor Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative

### 3.2.5.1.7 Electrical and Fire Alarm Systems Test Team

The following team members must participate in Functional Performance and Integrated Systems Testing of electrical systems:

Designation	Function
CxE	Electrical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative

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Designation	Function
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative
ED	Electrical Designer

#### 3.2.5.1.8 Security System Pre-Functional Checks Team

The following team members must participate in Functional Performance and Integrated Systems Testing of Security Systems:

Designation	Function
CxSS	Security System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
SSC	Contractor's Security Commissioning Representative

#### 3.2.5.1.9 Other Pre-Functional and Functional Performance Participants

The following may participate as team members during Pre-Functional Checks and Functional Performance Testing:

[illegible]

### 3.2.5.2 Pre-Functional Checks

Pre-Functional Checklists from the approved Final Construction Phase Commissioning Plan must be completed by the commissioning team. Complete one Pre-Functional Checklist for each individual item of equipment or system for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting and plumbing), and controls. Indicate commissioning team member inspection and acceptance of each Pre-Functional Checklist item by initials. Acceptance of each Pre-Functional Checklist item by each team member indicates that item conforms to the construction contract and accepted design requirements in their area of responsibility. Technical Commissioning Specialist acceptance of each Pre-Functional Checklist item indicates that each item has been installed correctly and in accordance with contract

documents and the Owner's Project Requirements. Submit the completed and initialed Pre-Functional Checklists no later than 7 calendar days after completion of inspection of all checklist items for each system. Submit one hard copy and an electronic copy. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists.

#### 3.2.5.3 Testing, Adjusting, and Balancing (TAB) Report and Field Acceptance Testing

The Mechanical System Technical Commissioning Specialist must review the pre-final TAB Report required by UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. Resolve all deficiencies prior to TAB Field Acceptance Testing.

The Mechanical System Technical Commissioning Specialist must witness the TAB Field Acceptance Testing specified by UFGS Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Include a certification by the Mechanical Technical Specialist that no outstanding deficiencies exist in the systems relative to Testing, Adjusting, and Balancing with the final TAB Report submittal.

#### 3.2.5.4 HVAC Controls Test Reports

The Mechanical System Technical Commissioning Specialist must review the Start-Up Testing Report and the PVT Procedures and Reports required by UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Include a certification by the Mechanical System Technical Commissioning Specialist that the submittals contain no deficiencies or that the submittals do not indicate any deficiencies in the HVAC systems or HVAC control systems with each of these submittals.

#### 3.2.5.5 Tests

##### 3.2.5.5.1 Functional Performance and Integrated Systems Tests

Schedule Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. Correct all deficiencies identified through any prior review, inspection, or test activity before the start of Functional Performance Tests. Perform Integrated Systems Tests only after the Functional Performance Tests for each associated system are completed with all deficiencies resolved and after the related Functional Performance Test Checklists have been signed by each commissioning team member.

- a. Functional Performance Tests and Integrated Systems Tests must be performed with the Contracting Officer's Quality Assurance Representative present.
- b. Abort Functional Performance Tests or Integrated Systems Tests when any system deficiency prevents the successful completion of the test.
- c. Technical Commissioning Specialists must lead and document all Functional Performance Tests and Integrated Systems Tests for the systems to be commissioned with the Contractor and appropriate sub-contractors performing the Functional Performance Tests and Integrated Systems Tests. The representatives listed in the paragraph Commissioning Team must attend the tests. Abort Functional



Performance Tests or Integrated Systems Tests when any required commissioning team member is not present for the test.

#### 3.2.5.5.1.1 Checklist

Use the Functional Performance Test and Integrated Systems Test Checklists from the approved Final Construction Phase Commissioning Plan to guide the Functional Performance Tests and Integrated Systems Tests. Functional Performance Tests must be performed for each item of equipment and each system required to be commissioned and verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other performance requirements comply with construction contract and accepted design requirements regardless of the specific items listed within the Functional Performance Test and Integrated Systems Test Checklists provided. Testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. Integrated Systems Tests must be performed for the interactive operation between systems such as HVAC systems, fire protection systems, back-up electrical supply, and other systems, and verify correct interactive operation, acceptable speed of response, and other contract requirements for both normal and failure modes. Examples of Integrated Systems Tests include the the correct room directional airflow during various system and component failures, the worst case simulation of the effluent decontamination system, correct operation of HVAC systems during emergency system activation, the anti-terrorism/force protection safety, or lighting system operation during power outage or emergency system activation. The order of components and systems to be tested must be determined by the Technical Commissioning Specialists.

#### 3.2.5.5.1.2 Acceptance

Indicate acceptance of each item of equipment and systems tested by signature of each commissioning team member for each Functional Performance Test or Integrated Systems Test Checklist. The Contractor's Quality Control Representative and the Technical Commissioning Specialists must indicate acceptance after the equipment and systems are free of deficiencies.

#### 3.2.5.5.2 HVAC Test Methods

Perform Functional Performance Tests in accordance with the following:

##### 3.2.5.5.2.1 Prior to Testing

Prior to testing operating modes, sequences of operation, interlocks, and safeties, complete control point-to-point observations, test sensor calibrations, and test actuator commands.

##### 3.2.5.5.2.2 Simulating Conditions

Over-writing control input values through the controls system is not acceptable, unless approved by the Contracting Officer's Representative. Identify proposed exceptions in a protocol submitted to the Contracting Officer's Representative for approval. Before simulating conditions, overwriting values (if approved), or changing set-points, calibrate all sensors, transducers and devices. Below are several examples of exceptions that would be considered acceptable:

- a. When varying static pressures inside ductwork can not be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various set-points, nor to simulate an electric analog signal (unless approved as noted above).
- b. Dirty filter pressure drops can be simulated using sheets of cardboard at filter face.
- c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.
- d. High outside air temperatures can be simulated with a hair blower.
- e. High entering cooling coil temperatures can be used to simulate entering cooling coil conditions.
- f. Do not use signal generators to simulate sensor signals unless approved by the Contracting Officer's Representative, as noted above, for special cases.
- g. Control set points can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature below 55 degrees F, when the outside air temperature is above 55 degrees F, temporarily change the lockout set point to be 0 degrees F above the current outside air temperature. Caution: Set points are not to be raised or lowered to a point such that damage to the components, systems, or the building structure and/or contents will occur.
- h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform the tests with air system at minimum airflow condition in ductwork.
- i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting the set point on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is conducted, return the set point to its original set-point or a set-point as indicated by the Contracting Officer's Representative.

#### 3.2.5.5.2.3 Setup

Perform each test under conditions that simulate actual conditions as close as is practically possible. Provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures, and other conditions necessary to execute the test according to the specified conditions. At completion of the test, return the affected building equipment and systems to their pre-test condition.

#### 3.2.5.5.3 Sample Strategy

Perform Functional Performance Tests and Integrated Systems Tests for all equipment and systems. Prepare and complete a Functional Performance Test Checklist for each item of equipment or system. Prepare and complete an Integrated Systems Test Checklist for each item of equipment or system.

#### 3.2.5.5.4 Seasonal Tests

##### 3.2.5.5.4.1 Initial Functional Performance Tests

Perform Initial Functional Performance Tests as soon as all contract work is completed, regardless of the season. Develop and implement means of artificial loading to demonstrate, to a reasonable level of confidence, the ability of the HVAC systems to handle peak seasonal loads.

##### 3.2.5.5.4.2 Full-Load Conditions

In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems under full-load conditions during peak heating and cooling seasons during outdoor air condition design extremes. Test cooling equipment and systems with the building fully occupied when performing the Functional Performance Tests during peak cooling season.

Schedule Seasonal Functional Performance Tests in coordination with the Government.

##### 3.2.5.5.4.3 System Acceptance

Systems may be partially accepted by the Government prior to seasonal testing if they comply with all construction contract and accepted design requirements that can be tested during initial Functional Performance Tests. All Functional Performance Test procedures must be completed prior to full systems acceptance.

##### 3.2.5.5.5 Aborted Tests and Re-Testing

Abort Functional Performance Tests, Integrated Systems Tests, or Seasonal Tests if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Reimburse the Government for all costs associated with effort lost due to re-testing due to test failures and aborted tests. These costs must include salary, travel costs, and per diem for Government commissioning team members. Re-test only after all deficiencies identified during the original tests have been corrected.

##### 3.2.5.5.5.1 100 Percent Sample

Functional performance tests shall be performed on all (100% of) systems, equipment, rooms, and components in the commissioning scope defined above. Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 5 minutes during the test.

Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.

#### 3.2.6 Training Plan

Develop a training plan which identifies all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the

trainer name, trainer contact information, and schedule and location of training. Submit one hard copy and an electronic copy of the Training Plan to the Commissioning Specialists and the Government no later than 30 calendar days prior to the associated training.

Document training attendance using training attendance rosters and provide completed attendance rosters to the Commissioning Specialists and the Government no later than 7 calendar days following the completion of training for each system to be commissioned. Submit one hard copy and an electronic copy..

### 3.2.7 Systems Manual

Prepare and submit a Systems Manual including a signed certification or letter from the Technical Commissioning Specialists and the Lead Commissioning Specialist stating that the Systems Manual is complete, clear, and accurate. The Systems Manual, for all commissioned systems, must conform to Appendix A SYSTEMS MANUAL ORGANIZATION AND CONTENT to ER 25-345-1, available at the USACE Publications website at the following location:  
<https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations/>. Update and resubmit the Systems Manual based on any corrective action taken during the warranty period.

Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests and Integrated Systems Tests. Submit three hard copies and an electronic copy.

### 3.2.8 Maintenance and Service Life Plans

#### 3.2.8.1 Maintenance Plan

Prepare and submit a Maintenance Plan for the project mechanical, electrical, plumbing, and fire protection systems. Prepare the HVAC section of the Maintenance Plan in accordance with ASHRAE 180. Develop required inspection and maintenance tasks similar to Section 5 of ASHRAE 180 for the other commissioned systems and fire protection systems.

Submit the Maintenance Plan no later than 30 calendar days following the completion of Functional Performance Tests and Integrated Systems Tests. Submit three hard copies and an electronic copy.

#### 3.2.8.2 DMLSS Data Entry and Verification

Provide information to MRDC/USAMRIID as required for them to complete the asset data and maintenance procedures and scheduling in the DMLSS system already established for the existing building. Review and verify the accuracy of data entered by MRDC/USAMRIID. Coordinate the process with MRDC/USAMRIID. Data provided and verified shall include:

- a. Asset data including manufacture, model number, serial number, rating and performance data
- b. Maintenance procedures with required frequency.

### 3.3 COMMISSIONING REPORT

Following the completion of Functional Performance Tests and Integrated Systems Tests, with the exception of Seasonal Tests, the Lead

Commissioning Specialist must prepare a Commissioning Report.

- a. Include an executive summary describing the overall commissioning process, the results of the commissioning process, any outstanding deficiencies and recommended resolutions, and any seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the construction contract and accepted design and the Owner's Project Requirements.
- b. Detail any deficiencies discovered during the commissioning process and the corrective actions taken in the report. Include the completed Pre-Functional Checklists, Functional Performance Test Checklists, Integrated Systems Test Checklists, the Commissioning Plans, the Issues Log, Performance Verification Test Reports, Training Attendance Rosters, the Design Review Report, the final TAB Report.
- c. Submit the Commissioning Report no later than 14 calendar days following commissioning team acceptance of all Functional Performance Tests and Integrated Systems Tests with the exception of Seasonal Tests. Submit three hard copies and an electronic copy.
- d. Following any Seasonal Tests or Post-Construction Activities, update the Final Commissioning Report to reflect any changes and resubmit. File the approved, updated, Final Commissioning Report in the Sustainability eNotebook.

### 3.4 POST-CONSTRUCTION SUPPORT

#### 3.4.1 Post-Construction Endurance Test

Perform an Endurance Test in accordance with the paragraph Endurance Test in UFGS Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC once during the peak heating season and once during the peak cooling season during outdoor air condition extremes with the exception that network bandwidth usage measurement and recording is not required.

The Mechanical System Commissioning Specialists must review the trend logs from the Endurance Tests to ensure that the systems have stable operation and operate as required by the construction contract, the accepted design, and the Owner's Project Requirements Document. The Commissioning Specialists must provide a Post-Construction Trend Log Report that identifies any deficiencies noted in operation, recommendations for correction, and includes a graphical representation of the trends. Provide one Trend Log Report for the peak cooling season and one Trend Log Report for the peak heating season. Submit one hard copy and one electronic copy of the Post-Construction Trend Log Reports no later than 14 calendar days following receipt of the trend log data by the Commissioning Specialist.

**APPENDIX A - OWNER'S PROJECT REQUIREMENTS DOCUMENT**

DRAFT

**OWNER'S PROJECT REQUIREMENTS DOCUMENT**

Project: Building 8100 Steam Sterilization Plant, Ft. Detrick Maryland,  
PN #####

Approved:

Name	Design Agent's Representative	Date
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Name	Owner's Representative	Date
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DRAFT

**OWNER'S PROJECT REQUIREMENTS DOCUMENT**

Owner's Project requirements shall be finally developed by the DB Design team in collaboration with the Cx Firm based on the RFP narratives which outline the requirements in more detail. It shall be submitted for review and approval by COR, USAMRIID (Facilities and Safety), MRDC, DA Safety. Once approved it shall be inserted here during Schematic Design.

-- End of Section --



SECTION 02 41 00

DEMOLITION AND DECONSTRUCTION  
10/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 145 (1991; R 2012) Standard Specification for  
Classification of Soils and Soil-Aggregate  
Mixtures for Highway Construction Purposes

AASHTO T 180 (2017) Standard Method of Test for  
Moisture-Density Relations of Soils Using  
a 4.54-kg (10-lb) Rammer and a 457-mm  
(18-in.) Drop

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition  
Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health  
Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61 National Emission Standards for Hazardous  
Air Pollutants

1.2 GENERAL REQUIREMENTS

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. Remove rubbish and debris from the station daily; do not allow accumulations inside or outside the building. The work includes demolition and deconstruction, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

## Repair Steam Sterilization Plant (SSP)

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Existing Conditions; G AR

### SD-07 Certificates

Demolition and Deconstruction Plan; G

Notifications; G

Proposed salvage, demolition, deconstruction, and removal procedures for approval before work is started.

### SD-11 Closeout Submittals

Receipts

Receipts or bills of lading, as specified.

## 1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6.

### 1.4.1 Notifications

#### 1.4.1.1 General Requirements

Furnish timely notification of demolition deconstruction and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M.

### 1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

## 1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of the building to existing egress paths, to exterior pedestrian and vehicular traffic, to surrounding buildings and to parking lots. Avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily.

## 1.6 PROTECTION

### 1.6.1 Traffic Control Signs

Where pedestrian and driver vehicular traffic safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor

barricades in a manner to prevent displacement by wind. Notify the Contracting Officer prior to beginning such work.

#### 1.6.2 Existing Conditions Documentation

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Notify Contracting Officer immediately with discrepancies.

#### 1.6.3 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements and pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

#### 1.6.4 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in work areas and to other surrounding areas. Remove snow, dust, dirt, and debris from areas daily. Notify Contracting Officer for approval to proceed with removal of snow, dust, dirt and debris from areas outside the designated work area.

#### 1.6.5 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

#### 1.6.6 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

#### 1.6.7 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

#### 1.6.8 Protection of Personnel

Before, during and after the demolition and deconstruction work the Contractor shall continuously evaluate the condition of the structure being demolished and deconstructed and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

#### 1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

#### 1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the Contracting Officer.

#### 1.9 REQUIRED DATA

Prepare a Demolition and Deconstruction Plan. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures

## Repair Steam Sterilization Plant (SSP)

for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

### 1.10 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

### 1.11 USE OF EXPLOSIVES

Use of explosives will be permitted.

## PART 2 PRODUCTS

### 2.1 FILL MATERIAL

Comply with excavating, backfilling, and compacting procedures for soils used as backfill material, as specified in Section 31 00 00, to fill voids, depressions or excavations resulting from demolition or deconstruction of structures.

Proposed fill material must be sampled and tested by an approved soil testing laboratory, as specified in Section 31 00 00.

Soil classification AASHTO M 145

Moisture-density relations AASHTO T 180, Method B or D

## PART 3 EXECUTION

### 3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures on site for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse on site whenever possible.

#### 3.1.1 Structures

- a. Remove existing structures indicated to be removed. Remove sidewalks, curbs, concrete pads, fencing, gutters and street light bases as indicated.
- b. Deconstruct structures in a systematic manner from the top of the structure to the ground. Remove concrete and masonry walls in small sections.
- c. Locate demolition and deconstruction equipment throughout so as to not impose excessive loads to supporting walls, floors, or framing of adjacent structures.

#### 3.1.2 Utilities and Related Equipment

##### 3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not

interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

#### 3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

#### 3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 40 foot lengths and store in rolls off the ground.

#### 3.1.4 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs designated to be recycled and utilized in this project shall be moved, ground and stored as directed by the Contracting Officer. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

#### 3.1.5 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Salvage removed concrete.

#### 3.1.6 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated.

#### 3.1.7 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Salvage for recycle structural steel, steel joists, girders, angles, plates, columns and shapes. Flame-cutting torches are permitted when other methods of dismantling are not

practical. Transport structural steel shapes to a designated area as directed by the Contracting Officer, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

### 3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, and other hazardous openings.

### 3.3 DISPOSITION OF MATERIAL

#### 3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

#### 3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed in the Demolition and Deconstruction Plans indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

### 3.4 CLEANUP

Remove debris and rubbish from excavations. Remove and transport the in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

### 3.5 DISPOSAL OF REMOVED MATERIALS

#### 3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified, off the site.

In the Waste Management Plan. Storage of removed materials on the project site is prohibited.

#### 3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

### 3.5.3 Removal from Government Property

Transport waste materials removed from deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

### 3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition. Salvage copper and telecommunication manholes.

-- End of Section --



SECTION 03 45 01.00 10

PRECAST ARCHITECTURAL CONCRETE  
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

- ACI 211.1 (1991; R 2002) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- ACI 318 (2005) Building Code Requirements for Structural Concrete and Commentary
- ACI SP-66 (2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

- AWS D1.1/D1.1M (2006; Errata 2006) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

- ASTM C 1017/C 1017M (2003) Chemical Admixtures for Use in Producing Flowing Concrete
- ASTM C 1077 (2007) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
- ASTM C 1260 (2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- ASTM C 1567 (2004) Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
- ASTM C 494/C 494M (2005a) Standard Specification for Chemical Admixtures for Concrete
- ASTM E 329 (2007a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-117	(1996) Quality Control for Plants and Production of Architectural Precast Concrete Products
PCI MNL-120	(2004) Design Handbook - Precast and Prestressed Concrete
PCI MNL-122	(1989) Architectural Precast Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection; G, AE

Detail drawings showing details in accordance with ACI SP-66 and ACI 318, including installation details. Detail drawings shall indicate separate identification marks for each different precast unit, location of units in the work, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, blocking points for units stored at the precast concrete plant or at the jobsite, lifting points and special handling instructions in sufficient detail to cover manufacture, handling, and erection.

SD-04 Samples

Precast Concrete Units; G, AE

Three 12 by 12 by 2 inch samples of each type of precast unit finish required for the project. Submitted samples shall show matrix color, surface color, surface texture, color range and panel back finish. Following approval of the above samples the full size mockups shall be manufactured.

Mock-up; G, AE

Full-size mock-ups (minimum 4'-0" by 8'-0"), maintained at the precast concrete manufacturer's plant until approval by the Contracting Officer. Upon Contracting Officer approval one set of mock-up units shall be moved to the project site and another set shall remain at plant for quality control purposes. The mock-ups shall be used to establish quality, acceptable color range and acceptance of precast units to be used on the project, and shall consist of three or more units of each exposed surface finish specified in Part 2 of this Section, showing the exterior finish (matrix color, surface color, surface texture), panel back finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts, and other accessories. Mockups shall also include typical joints, including exterior corner joints and joints between units. Include patching installation for each

color, texture and pattern of precast.

Provide mock-ups required to be included in the exterior wall mock-ups detailed.

#### SD-05 Design Data

Calculations; G, AE

Design calculations, prior to the manufacture of any precast architectural concrete units for the project.

Mix Design; G, AE

A statement on the mix design formulas, as specified.

Manufacturer's Qualifications

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

#### SD-06 Test Reports

Materials

Certified copies of test reports including test data and test results. Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory, except that compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory.

#### SD-07 Certificates

Installer Qualifications; G, AR  
Field Auditor Qualifications; G, AR  
Fabricator Qualifications; G, AR

### 1.3 GENERAL REQUIREMENTS AND QUALITY ASSURANCE

Precast concrete units shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer certified under the PCI Plant Certification Program. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings for at least 3 years. The Contractor shall submit a statement detailing the Manufacturer's Qualifications as specified in the Submittals paragraph. Precast work shall be coordinated with the work of other trades.

#### 1.3.1 Installer Qualifications

A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.

#### 1.3.2 Field Auditor Qualifications

A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project before erection of precast concrete and who can produce an

Erectors' Post-Audit Declaration.

### 1.3.3 Fabricator Qualifications

A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified Professional Engineer registered in the United States of America.

#### 1.3.3.1 PCI Plant Certification Program

Participates in PCI's plant certification program at time of bidding and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.

### 1.3.4 Testing Agency Qualifications

An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

### 1.3.5 Design Standards

Comply with ACI 318 and design recommendations of PCI MNL-120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

### 1.3.6 Quality-Control Standard

For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL-117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

## 1.4 DESIGN

### 1.4.1 Standards and Loads

Precast unit design shall conform to ACI 318 and PCI MNL-120. Design loads for precast concrete shall be as specified. Design loads shall include loads from other assemblies as required. Building structure has been designed to accept gravity loads from precast panels at building columns or precast support posts shown on the structural drawings. Miscellaneous steel supports, anchors and attachments are required to resist lateral loads. A differential temperature of 160 degrees F, between interior and exterior faces of the units, shall be considered in the design. Stresses due to restrained volume change caused by shrinkage and temperature differential, handling, transportation and erection shall be accounted for in the design.

### 1.4.2 Connections

- a. Connection of units to building structure shall be of the general type and configuration indicated. Connection to other units shall be by Contractor, subject to review by AE. Connections shall be detailed to avoid interference with partitions and column enclosures. The design and sizing of connections for all design loads shall be by the Contractor.

- b. The following information is provided for bidding purposes only. The final design of the panel connections to the specified blast loads will remain the responsibility of the bidder. The contractor may use the information shown in the table below to estimate inbound blast loads on the connections. Rebound loads may be estimated at 50 percent of the inbound loads. These loads should only need to be combined with the actual dead loads on the panel for sizing the connections for bidding.

Equivalent static load (psf) Table

Panel Type (psf)	Length (ft)	Height (ft)	Equivalent Static Load
1A	18	65.33	789
1A	24	65.33	737
1A	32	65.33	712
1B	18	10.67	310
1B	24	10.67	248
1B	32	10.67	212
2	20	11	560
2	37	11	860
3	18	Spans 1-Way	171
3	24	Spans 1-Way	96
3	32	Spans 1-Way	54

#### 1.4.3 Concrete Strength

Precast concrete units shall have a minimum 28-day compressive strength of 5000 psi.

#### 1.4.4 Concrete Proportion

Selection of proportions for concrete shall be based on the methodology presented in ACI 211.1 for normal weight concrete. The concrete proportion shall be developed using the same type and brand of cement, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Calcium chloride shall not be used in precast concrete and admixtures containing chloride ions, nitrates, or other substances that are corrosive shall not be used in prestressed concrete.

#### 1.4.5 Calculations

Calculations for design of members and connections shall be made by a professional engineer experienced in the design of precast architectural concrete and licensed in the United States of America. Calculation shall include the analysis of member for lifting stresses and the sizing of the lifting inserts.

#### 1.4.6 Mix Design

The Contractor shall submit the mix design formula giving the maximum nominal coarse aggregate size, the proportions of all ingredients and the type and amount of any admixtures that will be used in the manufacture of each strength and type of concrete, prior to commencing operations. Submit certified copies of laboratory test reports, including mill tests

and all other test data, for portland cement, pozzolan, slag cement, aggregates, and alkali aggregate reactivity. The statement shall be accompanied by test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made without additional tests to verify that the concrete properties are satisfactory.

#### 1.4.7 Mock-up

- A. After samples are approved for color, finish and texture, fabricate and erect at production plant, full size precast wall units, illustrating size, shape, lifting, anchor and attachment points, and finish range in accordance with approved sample.
- B. Provide products and installation for portion of work specified in this Section 03 45 01.00 10 and indicated for exterior on-site mock-up on Drawing A3.31.

#### 1.5 STORAGE AND INSPECTION AT MANUFACTURER'S PLANT

Precast units temporarily stored at the manufacturer's plant shall be protected from damage in accordance with PCI MNL-117. Immediately prior to shipment to the jobsite, all precast concrete units shall be inspected for quality to insure all precast units conform to the requirements specified. Inspection for quality shall include, but shall not necessarily be limited to, the following elements: color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.

#### 1.6 HANDLING AND STORAGE

Precast units shall be delivered to the site in accordance with delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite all precast units shall be inspected for quality as specified above. If the precast units cannot be unloaded and placed directly into the work, they shall be stored onsite, off the ground and protected from weather, marring, or overload. Precast units shall be handled in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Except as otherwise specified, material shall conform to Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE and Section 03 20 01.00 10 CONCRETE REINFORCEMENT.

##### 2.1.1 Aggregates

Fine and coarse aggregates proposed for use in concrete shall be tested and evaluated for alkali-aggregate reactivity in accordance with ASTM C 1260. The fine and coarse aggregates shall be evaluated separately and in combination, which matches the Contractor's proposed mix design proportioning. All results of the separate and combination testing shall have a measured expansion less than 0.10 percent at 16 days after casting. Should the test data indicate an expansion of 0.10 percent or greater, the aggregate(s) shall be rejected or additional testing using ASTM C 1260 and ASTM C 1567 shall be performed.

### 2.1.2 Portland Cement, Slag Cement and Fly Ash

The additional testing using ASTM C 1260 and ASTM C 1567 shall be performed using the low alkali portland cement in combination with slag cement, or fly ash. Slag cement shall be used in the range of 15 to 35 percent of the total cementitious material by weight. Fly ash shall be used in the range of 15 to 35 percent of the total cementitious material by weight. Slag cement and fly ash may be combined to contain 15 to 35 percent of the total cementitious material by weight.

### 2.1.3 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 1 inch or less.

### 2.1.4 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

### 2.1.5 Inserts

Inserts shall be manufacturer's, suited for the application.

### 2.1.6 Plates, Angles, Anchors and Embedments

Material shall be as specified in PCI MNL-117. Steel items, other than stainless, shall be coated with a rust-inhibiting paint or shall be hot-dip galvanized. Steel items, including items embedded in concrete, shall be either stainless steel or hot dip galvanized steel. Below grade items shall be stainless steel. Provide stainless steel where indicated.

### 2.1.7 Form Release Agent

Release agent shall be manufacturer's standard nonstaining type.

### 2.1.8 Admixtures

Admixtures shall conform to ASTM C 494/C 494M. Plasticizing admixture, if used, shall conform to ASTM C 1017/C 1017M.

## 2.2 PRECAST CONCRETE UNITS

Precast concrete units shall be manufactured and cured in accordance with the applicable provisions of PCI MNL-117. Units shall be manufactured within the allowable tolerances given in PCI MNL-117 and PCI MNL-120.

### 2.2.1 Formwork

Forms shall be steel of adequate thickness, braced, stiffened, anchored and aligned to produce precast architectural concrete units within required dimensional tolerances. Forms shall be sufficiently rigid to provide dimensional stability during handling and concrete placement and consolidation. Fiberglass-reinforced plastic, plastic coated wood, elastomeric or other nonabsorptive material shall be used for making tight joints and rustication pieces.

### 2.2.2 Reinforcement

Fabrication and placement of reinforcement shall conform to the details shown on the approved detail drawings and PCI MNL-117.

### 2.2.3 Embedded Accessories

Anchors, inserts, lifting devices, and other accessories which are to be embedded in the precast units shall be furnished and installed in accordance with the approved detail drawings. Embedded items shall be accurately positioned in their designed location, and shall have sufficient anchorage and embedment to satisfy design requirements.

### 2.2.4 Stripping

Precast concrete units shall not be removed from forms until units develop sufficient strength to safely strip the formwork and to remove the precast concrete units from the forms to prevent damage to the units from overstress or chipping.

### 2.2.5 Identification

Each precast concrete unit shall be marked to correspond to the identification marks for each different precast unit shown on the detail drawings.

### 2.2.6 Finishes

#### 2.2.6.1 Exposed Surfaces

Surfaces of precast units exposed to view or surfaces indicated to be finished shall be finished as follows: Match AE samples provided by Gate Precast Company, Gate Stone Series Lite Rustification Variegate Honed Unfilled Samples.

Type 1: Light Gray, Baking soda finish.

Type 2: Dark Gray, Ribbed

Type 3: Light Gray, Light sand blasted finish

#### 2.2.6.2 Other Surfaces

Surfaces of precast units not exposed to view or not otherwise indicated to be finished shall be finished in accordance with Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

## PART 3 EXECUTION

### 3.1 ERECTION

Precast units shall be erected in accordance with the detail drawings and without damage to other units or to adjacent members. Units shall be set true to alignment and level, with joints properly spaced and aligned both vertically and horizontally. Erection tolerances shall be in accordance with the requirements of PCI MNL-117 and PCI MNL-122. As units are being erected, shims and wedges shall be placed as required to maintain correct alignment. After final attachment, precast units shall be grouted as shown. After erection, welds and abraded surfaces of steel shall be



cleaned and touched-up with a zinc-rich paint. Welds shall be made by a certified welder in accordance with the manufacturer's erection drawings. Pickup points, boxouts, inserts, and similar items shall be finished to match adjacent areas after erection. Erection of precast units shall be supervised and performed by workmen skilled in this type of work. Welding and the qualifications of welders shall be in accordance with AWS D1.1/D1.1M.

### 3.2 JOINT SEALING

Joint sealing shall be as specified in Section 07 92 00 JOINT SEALANTS.

### 3.3 CLEANING

Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast concrete discolored during erection shall be cleaned to remove dirt and stains by dry scrubbing with a stiff fiber brush, wetting the surface and vigorous scrubbing of the finish with a stiff fiber brush followed by additional washing, or by chemical cleaning compounds such as detergents or other commercial cleaners. Commercial cleaners shall be used in accordance with the manufacturer's recommendations. Cleaning procedure shall be performed on a designated test area and shall be approved prior to proceeding with cleaning work. Discolorations which cannot be removed by these procedures, will be considered defective work. Cleaning work shall be done when temperature and humidity permit surfaces to dry rapidly. Adjacent surfaces shall not be damaged during cleaning operations.

### 3.4 PROTECTION OF WORK

Precast units shall be protected against damage from subsequent operations.

### 3.5 DEFECTIVE WORK

Precast concrete units damaged during erection shall be repaired as soon after occurrence as possible or replaced, as directed, using approved procedures. All repairs to precast concrete units shall match the adjacent surfaces in color and texture and shall be as approved. Unless otherwise approved, repair procedures shall conform to PCI MNL-117.

#### 3.5.1 Rejection

Panels in place may be rejected for any one of the following product defects or installation deficiencies remaining after repairs and cleaning have been accomplished. "Visible" means visible to a person with normal eyesight when viewed from a distance of 20 feet in broad daylight.

- a. Nonconformance to specified tolerances.
- b. Air voids (bugholes or blowholes) larger than  $\frac{3}{8}$  inch diameter.
- c. Visible casting lines.
- d. Visible form joints.
- e. Visible irregularities.
- f. Visible stains on panel surfaces.

- g. Visible differences between panel and approved sample.
- h. Visible nonuniformity of textures or color.
- i. Visible areas of backup concrete bleeding through the facing concrete.
- j. Visible foreign material embedded in the face.
- k. Visible repairs.
- l. Visible reinforcement shadow lines.
- m. Visible cracks.

### 3.6 INSPECTION

#### 3.6.1 Field Quality Control

Perform field inspection of connections. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts and washers within 7 working days of the date of inspection. All defective connections or welds shall be removed and re-welded or repaired as required by the Contracting Officer.

#### 3.6.2 Welded Connection Visual Inspection

AWS D1.1/D1.1M, furnish the services of AWS-certified welding inspector for erection inspections. Welding inspector shall visually inspect all welds and identify all defective welds.

-- End of Section --

SECTION 08 11 13

STEEL DOORS AND FRAMES

07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2006; Errata 2006) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 591 (1998) Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications

ASTM A 653/A 653M (2007) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (2007) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM E 283 (2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A115 (2006)(Complete Set - Spec dates Vary) Specifications for Door and Frame Preparation for Hardware (Incl A115.1 (1990), A115.2 (1987), A115.4 (1994), A115.5 (1992), A115.6 (1993), A115.12 (1994), A115.13 (1991), A115.14 (1994), A115.15 (1994), A115.16 (1990), A115.17 (1994), A115.18 (1994))

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA HMM (1992) Hollow Metal Manual

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2004) Procedure for Determining

*Fenestration Product U-Factors*

NFRC 400

*(2004) Procedure for Determining  
Fenestration Product Air Leakage*

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80

(2007) Standard for Fire Doors and Other  
Opening Protectives

NFPA 252

(2007) Standard Methods of Fire Tests of  
Door Assemblies

STEEL DOOR INSTITUTE (SDI/Door)

SDI 105

(1998) Recommended Erection Instructions  
for Steel Frames

SDI/DOOR A250.6

(2003) Hardware on Steel Doors  
(Reinforcement - Application)

SDI/DOOR A250.8

(2003) Recommended Specification for  
Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C

(1998) Standard for Positive Pressure Fire  
Tests of Door Assemblies

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL  
PROCEDURES.

SD-02 Shop Drawings

Doors; G, AR/AE

Frames; G, AR/AE

Accessories; G, AR/AE

Show elevations, construction details, internal reinforcement,  
cut outs for glazing, metal gages, hardware provisions, method of  
glazing, details of conduit and preparation for power, signal,  
control systems; finish and installation details.

Submit door and frame locations. Schedules: Use same reference  
numbers for openings as those in Section 08 06 00 DOOR AND FRAME  
SCHEDULE.

SD-03 Product Data

Doors; G, AR/AE

Frames; G, AR/AE

Accessories

Fire Rating: G, AR/AE

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, galvanizing and shop primer, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

### 1.4 MOCK-UPS

Provide products and installation as specified in this Section 08 11 13 for in-place mock-ups specified in Section 01 45 10.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware. Undercut where indicated. Exterior doors and all doors in special areas, (doors in Rooms indicated as Biosafety Level "Containment BSL-3E, ABSL-3E", and "BSL-2" as indicated on drawings A0.21, A0.21-X, A0.23, and A0.25) shall have top edge closed flush and sealed to prevent water intrusion. Provide continuous flush seal at bottom of doors in BSL-3E and A/BSL-3E except where recessed automatic door bottom is scheduled. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

#### 2.1.1 Classification - Level, Performance, Model

##### 2.1.1.1 Heavy Duty Doors

SDI/DOOR A250.8, Level 2, physical performance Level B, Model 2, with core construction as required by the manufacturer for interior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

##### 2.1.1.2 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 2 with **insulated** core construction as required by the manufacturer for exterior doors unless indicated otherwise, of size(s) and design(s) indicated. **Exterior doors U value and air leakage shall be as specified in this Section 08 11 13 under WEATHERSTRIPPING, subparagraph "Integral Gasket".** Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

## 2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design(s), materials, construction, gages, and finish shall be as specified for standard steel doors and shall comply with the requirement of NAAMM HMM. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE. Undercut doors as required for door hardware and sill conditions and as otherwise indicated. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

## 2.3 ACCESSORIES

### 2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated (~~deleted~~) doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies (~~deleted~~).

### 2.3.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

### 2.3.3 Vision Light Shutters

Vision Light Shutters: 14 gauge galvanized steel sheet with hardware:

- a. Piano Hinge: *Continuous stainless steel hinge*. Weld to shutter and attach to door with countersunk screws.
- b. *Recessed galvanized steel shutter pull*.
- c. Magnetic Catch: *Embedded magnet for hold OPEN/CLOSE*.
- d. Do not paint stainless steel hardware.

### 2.3.4 Insect Screen

Type 304 stainless steel screening, fine mesh 30 by 30, 0.011 inch wire diameter, opening size: 0.0223 inches square. Complies with Federal Specification Standard A-A-1037B for Type I, Class I wire fabric and complies with ASTM E-437 for industrial wire cloth and screens. Screen frame shall be compatible with door frame and mesh. Provide seal calk for screen perimeter to door.

## 2.4 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3, interior 4, exterior, except as otherwise

specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, transoms, sidelights, mullions, and interior glazed panels, unless otherwise indicated.

#### 2.4.1 Welded Frames

Continuously weld frame faces at corner joints. Continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

#### 2.4.2 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

#### 2.4.3 Glazing Stops and Beads

Form stops and beads from *minimum* 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws. Space fasteners approximately 12 to 16 inch on center *with a minimum of two screws per side*. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

#### 2.4.4 Terminated Stops

Where indicated, terminate interior door frame stops 6 inch above floor. Do not terminate stops of frames for lightproof, soundproof, or lead-lined doors.

#### 2.4.5 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

#### 2.4.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

##### 2.4.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to steel studs with sheet metal screws.

#### 2.4.6.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

### 2.5 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

#### 2.5.1 Door and Frame Labels, Fire Rating

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted. Stamped labels on frames may be provided only if label can be read after painting.

#### 2.5.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

#### 2.5.3 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. (Deleted).

### 2.6 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

#### 2.6.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Exterior door U value shall not exceed 0.7 per NFRC 100. Exterior door air leakage shall not exceed 0.4 cubic feet per minute per square foot per NFRC 400. U-value and Air leakage shall be determined by National Fenestration Rating Council accredited laboratory, and door openings shall be labeled and certified by the manufacturer. Integral gasket is not permitted in vivarium ABSL-2, ABSL-3E and BSL-3E.

### 2.7 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6.



Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers. **Do not punch door frames for adhesive applied silencers at ABSL-3E and BSL-3E openings.**

## 2.8 FINISHES

### 2.8.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8. Where coating is removed by welding, apply touchup of factory primer.

### 2.8.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8.

### 2.8.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

## 2.9 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 1/8 inch larger than the actual masonry thickness. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

### 2.9.1 Grouted Frames

For frames to be installed in masonry and concrete and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

### 2.9.2 Strike Boxes and Conduit

Prepare doors and frames for specified hardware and electrical devices in accordance with SDI/DOOR A250.8 and BHMA A115 (where applicable). Coordinate locations of conduit and wiring boxes for electrical connections with Section 28 20 01.00 10 ELECTRONIC SECURITY SYSTEM. Provide mortar guard boxes for concealed electrical devices.

### 2.10 SOUND RATED STEEL DOORS

Door 3NA142 shall have a STC 50 - See Section 08 06 00 DOOR AND FRAME SCHEDULE.

### 2.11 FOLDING INSECT SCREEN AND TRACK

At Ante Room 2SH402: Type 304 stainless steel screening, fine mesh 30 by 30, 0.011 inch wire diameter, opening size: 0.0223 inches square. Comply with Federal Specification Standard A-A-1037B for Type I, Class I wire fabric and comply with ASTM E-437 for industrial wire cloth and screens. Aluminum extruded track frame shall be compatible with screen and supporting opening. Frame shall be mounted with stainless steel tamper proof headed screws. Caulk outside frame to seal the frame to wall opening. Screen operation shall be manual **slide style folding custom insect curtain, a horizontal sliding track, under header in-jamb mounting**. Provide EPDM seals to assure a bug tight seal at edges.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed. Do not remove temporary spreaders until wall construction is complete.

#### 3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

#### 3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. (Deleted).

### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

DRAFT

SECTION 09 67 00

FLUID-APPLIED FLOORING

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- |            |   |
|------------|---|
| ASTM C811  | (1998; R 2003) Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing |
| ASTM D1308 | (2002; R 2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes  |
| ASTM D4541 | (2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers   |
| ASTM D523  | (2014; R 2018) Standard Test Method for Specular Gloss  |
| ASTM F1869 | (2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride         |
| ASTM F2170 | (2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes                           |

INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

- |            |  |
|------------|--|
| ICRI 03732 | (1997) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays |
|------------|--|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- |          |                         |
|----------|-------------------------|
| NFPA 101 | (2021) Life Safety Code |
|----------|-------------------------|

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- |             |  |
|-------------|--|
| 29 CFR 1910 | Occupational Safety and Health Standards |
|-------------|--|

## 1.2 SUMMARY

### 1.2.1 Section Includes

- A. High-performance fluid-applied flooring for use in A/BSL-3E and A/BSL-4 containment areas.
- B. Fluid-applied flooring for use outside containment areas.

### 1.2.2 Related Sections

- A. Section 01 33 10 SPECIAL SUBMITTAL PROCEDURES for validation of specification compliance prior to acceptance.
- B. Section 01 45 70 ROOM INTEGRITY TESTING.
- C. Section 01 67 00 MATERIAL/PRODUCT RESISTANCE for list of chemical and disinfectants.
- D. Section 01 91 00 COMMISSIONING.
- E. Section 03 31 05 HIGH CONTAINMENT CAST-IN-PLACE STRUCTURAL CONCRETE for repair of concrete substrates to receive fluid-applied flooring.
- F. Section 09 08 00 COMMISSIONING OF FINISHES.
- F. Section 09 97 00 SPECIAL COATINGS for coatings applied to concrete walls and ceilings.

## 1.3 DEFINITIONS

### 1.3.1 Pinhole

- A. Defect in top coat of fluid-applied flooring.
- B. Size: Appears as if created by point of a No. 20 pin. Minimum diameter: 6 mil.
- C. Depth: May or may not extend full depth of coating in which it occurs.

### 1.3.2 Pit

- A. Defect in top coat of fluid-applied flooring.
- B. Localized depression in fluid-applied flooring with straight sides.
- C. Size: 30 to 60 mil.
- D. Depth: May or may not extend full depth of coating in which it occurs.

### 1.3.3 Bug Hole

Small regular or irregular cavities, usually not exceeding 5/8-inch diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placing and compaction.

### 1.3.4 Smooth Finish

- A. Smoothness refers to physical texture or lack of texture of

fluid-applied flooring.

- B. Consistent finish with "no texture" to "very slight 'orange peel' texture".
- C. Finish RES5 will be evaluated for approval during Validation of Specification Compliance. Refer to Section 01 33 10 SPECIAL SUBMITTAL PROCEDURES. When providing samples for evaluation, provide sample that best reflects texture that can be expected during field application. Approved sample will form basis of acceptance for the finish to be applied during the Field Sample Mockup.
- D. Finish: 100 percent free of debris or 'sharps' trapped on surface of fluid-applied flooring.
- E. Smooth finish does not refer to flatness of concrete.
- F. Smooth finish does not refer to gloss of fluid-applied flooring.

#### 1.4 PERFORMANCE REQUIREMENTS

##### 1.4.1 Fluid-Applied Flooring in Containment Areas

- A. In A/BSL-4: Chemically resistant, easily cleanable, forming a sealed inner shell.
- B. In A/BSL-3E and A/BSL-4: capable of becoming integrated into a room that shall be tested for room integrity as described in Section 01 45 70 ROOM INTEGRITY TESTING.

##### 1.4.2 Acceptable Performance Requirements

Listed in Part 2 "Fluid-Applied Flooring Schedule".

#### 1.5 EARLY SUBMITTAL PACKAGE

##### 1.5.1 Submit

- A. Documentation verifying specification requirements will be met.
- B. Manufacturer's qualifications.
- C. Manufacturer's specifications on cured system and individual components of flooring system used in A/BSL-3E and A/BSL-4 areas.
- D. Manufacturer's technical data, performance properties, installation instructions, and recommendations of flooring system used in A/BSL-3E and A/BSL-4 areas.
- E. Verification of performance of proposed products against acceptance criteria specified in Article "Fluid-Applied Flooring Schedule" of this Section using 'in-house' methods.
- F. Installer's qualifications.

##### 1.5.2 Incomplete Submittal

Submittals with incomplete material for evaluation may be rejected.

## 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Early Submittal Package; G, AE

Product Schedule; G, AE

Provide early submittal package and schedule of material applications within 90 days after NTP. Use designations indicated in Fluid-Applied Flooring Schedule, and room number designations indicated on Drawings in Product Schedule.

### SD-02 Shop Drawings

Flooring; G, AE

Include flooring system component details and attachments to other Work.

Drawings indicating type and layout of floor systems including the following:

1. Flooring patterns, where applicable.
2. Divider and control and expansion joint strips coordinated with joints in concrete slab substrates.
3. Base and border strips.
4. Abrasive strips and non-slip locations.
5. Details for treatment of cold joints, control joints, random cracks, and expansion and isolation joints.

### SD-03 Product Data

Flooring; G, AE

Submit manufacturer's specifications on cured system and individual components of flooring system for each type of product specified.

Include manufacturer's descriptive technical data, performance properties; mixing, proportioning, and installation instructions and recommendations for each fluid-applied flooring component required.

Maintenance literature.

Submit Material Safety Data Sheets.

For tests not listed in manufacturer's standard product data, furnish missing data accompanied by an independent testing laboratory's test result which indicates compliance with referenced standards.

Samples of warranty.

SD-04 Samples

Flooring; G, AE

For Initial Selection:

Manufacturer's color charts showing full range of colors, textures, and patterns available for each fluid-applied flooring system indicated.

For Verification:

Of each fluid-applied flooring system specified, provide 6-inch by 6-inch square sample, applied by Installer for this Project to rigid backing, in color, texture, and finish indicated. Where finishes involve normal color and texture variations, include Sample sets showing full range of variations expected.

Mock-Up; G, AE

Cured samples of each floor finish or color combination.

SD-07 Certificates

Installer Certificates

Signed by manufacturer certifying that installers comply with specified requirements.

Installer: Furnish list of five projects using proposed material that has been installed during past 3 years, except for the past 10 years for RES5. Include following information:

1. Project Name.
2. Total area installed.
3. Owner contact name, address and phone number for each project listed.
4. Resumes of key project personnel, including top coat applicator, supervisors and mechanics, detailing experience.

Validation of Specification Compliance Report

From designated independent testing agency indicating and interpreting test results of fluid-applied flooring testing, substantiating compliance with requirements. Refer to Section 01 33 10 SPECIAL SUBMITTAL PROCEDURES.

Substrate Moisture Vapor Emission Certification and Test Reports

Contractor shall furnish certification from flooring system manufacturer stating that concrete substrate has been tested for moisture vapor emission, and that emission levels do not exceed flooring system manufacturers' recommendations. Provide copies of test reports.

SD-08 Manufacturer's Instructions

Application



Complete instructions for application of flooring system including any precautions or special handling instructions required to comply with OSHA 29 CFR 1910-Subpart Z.

SD-10 Operation and Maintenance Data

Flooring System: G, AR

Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

For each type of fluid-applied flooring. Include in maintenance manuals specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Provide complete description of final accepted preparation and installation methodology.

Provide complete instructions describing repair to physically damaged flooring.

SD-11 Closeout Submittals

Warranty

Warranty for flooring materials and installation

1.7 QUALITY ASSURANCE

1.7.1 Manufacturer Qualifications

Firm (material producer) with not less than 10 years of production experience.

1.7.2 Installer Qualifications

Experienced installer (applicator and top coat applicator) specializing in installing fluid-applied flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to fluid-applied flooring manufacturer, and as follows:

- A. Certified in writing by fluid-applied flooring manufacturer as qualified to install fluid-applied flooring systems specified.
- B. Mechanics applying the fluid applied flooring shall have a minimum number of years prior experience in handling and installing the type of materials specified as indicated and shall be under the direct supervision of manufacturer trained personnel.
  1. Finishes in A.BSL-3E and A/BSL-4: 10 years.
  2. Other areas: 3 years.
- C. RES5 top coat applicator shall have successfully applied same proposed top coat material. (This qualification refers to the actual person who will apply top coat for this project, not just the installation company.)

### 1.7.3 Source Limitations

Obtain primary fluid-applied flooring materials, including primers, resins, hardening agents, and top coats, through one source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

### 1.7.4 Regulatory Requirements

Coatings shall meet fire hazard classification requirements of jurisdictional authorities for each material in each installation location as applicable.

#### 1.7.4.1 Fire-Test-Response Characteristics

Fluid-applied flooring systems installed in corridors or access to corridors must comply with NFPA 101 Class I finish (Critical radiant flux not less than 0.45 W/cm<sup>2</sup>).

### 1.7.5 Pre-installation Conference

Conduct conference at Project site to comply with requirements in Section 01 31 19 PROJECT MEETINGS.

- A. Prior to commencing work of this section, attend pre-installation conference including Contractor, fluid-applied flooring applicator, COR, and flooring system manufacturer's representative.
- B. Review conditions of surfaces to be coated, and discuss use of materials and application procedures required to meet acceptance criteria specified in Article "Fluid-Applied Flooring Schedule" in this Section.
- C. Schedule pre-installation conference prior to required mock-up. Incorporate modifications to application procedure into mock-up.

### 1.7.6 Field Sample Mock-Up of Each Fluid-applied Flooring System

Provide full-thickness fluid-applied flooring system to one room of at least 100 sq. ft. in location selected by Government. Include costs of mock-up tests and reports in bid. Simulate finished lighting conditions for review of in-place field mock-up.

- A. Notify Government two (2) weeks prior to performing mock-up. Perform mock-up in presence of Government.
- B. Prepare substrate and apply fluid-applied flooring system as agreed upon at pre-installation conference. Adjust installation technique as required to gain acceptance.
- C. Top coat applicator designated in Article 'Quality Assurance' and accepted in Article 'Submittals' shall apply top coat product. This applicator shall be lead applicator for work of this project.
- D. RES5 only: The following material acceptance criteria must be demonstrated using Contractor-appointed and Government-approved independent testing agency. Include costs of tests and reports in bid price.

1. Chemical Resistance.
  2. Adhesion.
  3. Top Coat Finish.
  4. Coating System Thickness.
  5. Recoat Capability.
  6. Compatibility with Section 09 97 00 SPECIAL COATINGS.
  7. Resistance to high temperature and pressure water cleaning.
- E. If field mock-up is unacceptable, make adjustments to comply with requirements and apply additional samples until mock-up is approved. After mock-up is approved, these surfaces will be used to evaluate fluid-applied flooring as basis of acceptance.
- F. Obtain Contracting Officer's approval of mock-up before applying fluid-applied flooring. Approved mock-ups may become part of the completed Work if undisturbed at time of Beneficial Occupancy Date. Review of mockup shall be conducted after completion of slab preparation and preparation of joints and cracks in slab, after installation of matrix, after installation of topcoat, and after final joint treatment. Do not proceed with next step unless approval has been given for previous step.
- G. Coordinate installation of fluid-applied flooring mock-up with special coating mock-up specified in Section 09 97 00 SPECIAL COATINGS.

#### 1.8 DELIVERY, STORAGE AND HANDLING

##### 1.8.1 Delivery

Deliver materials to project site in unopened bags and containers clearly labeled with name of manufacturer, type of material, batch number, date of manufacture, component designation, product mix ratio, health and safety information, and emergency response information.

##### 1.8.2 Storage

- A. Store materials, other than aggregates, away from fire, sparks, or smoking areas. Maintain the storage area between 50 and 90 degrees F.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Do not use materials which exceed manufacturer's maximum recommended shelf life.

##### 1.8.3 Health and Fire Regulations

Ensure health and fire regulations are complied with in storage area, and during handling and application.

#### 1.9 ENVIRONMENTAL CONDITIONS

##### 1.9.1 Environmental Limitations

- A. Comply with fluid-applied flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting fluid-applied flooring installation. The use of temporary heat shall be with the written consent of the manufacturer and in accordance with their written recommendations.

B. Apply flooring systems only when:

1. Temperature, humidity and moisture content of substrate and room air have stabilized for minimum 24 hours before start of work, at values acceptable to flooring manufacturer for successful application.
2. Substrate temperature is minimum 3 degrees above dew point.
3. Floor surfaces have been vacuumed clean.

1.9.1.1 Slab Temperature

Slab temperature shall be not less than that recommended by manufacturer but no less than 50 degrees F before commencing installation, during installation and as required to ensure that substrate conditions do not have detrimental effect on completed product but not less than 72 hours after installation, unless otherwise recommended by flooring system manufacturer.

1.9.2 Lighting

Provide minimum 50 foot candles in floor installation areas.

1.9.3 Protection

Close spaces to traffic during fluid-applied flooring application, and for minimum 24 hours after application, unless manufacturer recommends longer period.

1.9.4 Dust Control

- A. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
- B. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate adjacent areas from noise generation due to grinding operations.

1.9.5 Ventilation

Apply fluid-applied flooring system only in ventilated, humidity-, and temperature-controlled environment accomplished by temporary or permanent building systems if allowed by provisions in the Contract Documents.

1.9.6 Substrate Tolerances

Substrate tolerances are specified in Section 03 31 05 HIGH CONTAINMENT CAST-IN-PLACE STRUCTURAL CONCRETE.

1.10 SEQUENCING

Schedule:

- A. Schedule application of fluid-applied flooring systems in A/BSL-4 areas as late as possible in project construction to allow cast-in-place concrete maximum time for shrinkage. Minimum concrete curing time prior to application of coatings shall be 6 months.

- B. Special coatings specified in Section 09 97 00 SPECIAL COATINGS and fluid-applied flooring must overlap each other. Coordinate construction activities accordingly and protect surfaces from damage by other trades.
- C. Following items must be installed before application of fluid-applied flooring:
  - 1. Embedded metal items including, but not limited to, plates, angles and channels, wall frames used to anchor or seal materials and equipment later in construction.
  - 2. Metal inserts to concrete floors for fastening exposed equipment, mechanical, plumbing and electrical services required.

#### 1.11 WARRANTY

The fluid-applied flooring manufacturer and installer shall warrant that fluid-applied flooring will be free from material and installation defects resulting in loss of bond, wear-through of top coat material, delamination, cracking, joint failure, and surface entrapped air bubbles for a period of not less than three (3) years from Beneficial Occupancy Date. The warranty shall cover materials and labor. In the event that defects occur within period stipulated, the Contractor shall effect repairs and replacements necessary to remedy defects.

#### 1.12 COMMISSIONING

Follow Section 09 08 00 COMMISSIONING OF FINISHES for Commissioning requirements related to finishes.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Products

- A. Subject to compliance with requirements, provide products for each designation in the Fluid-Applied Flooring Schedule.
- B. Products must meet acceptance criteria specified in this Section 09 67 00 FLUID-APPLIED FLOORING.

##### 2.1.2 General

- A. Each material and accessory used in fluid-applied flooring system shall be as recommended by the manufacturer or supplier of fluid-applied flooring.
- B. Materials (except aggregate) used in the flooring shall be the products of a single manufacturer.

##### 2.1.3 Fluid-Applied Flooring Materials

Resinous floor surfacing system consisting of primer; body coat(s) including resin, hardener, aggregates, fillers or flakes, and colorants, if any; elastomeric waterproofing membrane, and top coat(s). Refer to and comply with requirements indicated in the Fluid-Applied Flooring Schedule.

#### 2.1.4 Elastomeric Waterproofing Membrane

Manufacturer's 100 percent solids monolithic elastomeric resin recommended for waterproofing and crack isolation to help prevent substrate cracks from reflecting through resinous flooring, minimum 20 mils DFT.

#### 2.1.5 Patching and Fill Material

Resinous product of or approved by fluid-applied flooring manufacturer and recommended by manufacturer for application indicated.

#### 2.1.6 Divider/Transition Strips and Cove Cap Strip

- A. Divider Strips and cove cap strip: Zinc, shape and thickness indicated x depth of flooring. Zinc strips: 1/8-inch thick.
- B. Divider strip selections for flooring applications as detailed on Drawings, in longest lengths available.

#### 2.1.7 Joint Sealer

Joint Sealant: Type recommended or produced by fluid-applied flooring manufacturer for type of service and joint condition indicated.

Polysulphide or epoxy polysulphide, compatible with flooring systems, and resistant to disinfectants specified in Section 01 67 00 MATERIAL/PRODUCT RESISTANCE. High temperature sealant must be used at flooring to floor drain interface at autoclaves capable of withstanding temperature rise to 212 degrees F.

### 2.2 WALL BASE

#### 2.2.1 Self-Coving

Self-coving shall consist of same materials as flooring, designed for vertical application, coved up at the base as shown. Coved base shall be the same thickness as the flooring, except coved base shall be same thickness as top coats where applied to metal substrates.

### 2.3 FLUID-APPLIED FLOORING SCHEDULE

#### 2.3.1 Fluid Applied Flooring RES5

Fluid-applied flooring system consisting of primer/sealer, elastomeric waterproofing membrane, slurry body coat, top coats and sealer.

##### 2.3.1.1 Colors

Selections as indicated in Finish Legend on Drawings.

##### 2.3.1.2 Flooring System Thickness

- A. Slurry body coat: 1/4-inch minimum.
- B. DFT of top coat(s): 10 mil minimum.
- C. DFT of sealer coat: 10 mil minimum.

#### 2.3.1.3 Wearing Surface

Slip-resistant.

#### 2.3.1.4 Base

Integral cove.

#### 2.3.1.5 Chemical Resistance

Resistant to disinfectant gases and liquids and laboratory chemicals listed in Section 01 67 00 MATERIAL/PRODUCT RESISTANCE. Test resistance according to ASTM D1308, covered and open spot test. Acceptable resistance shall be minimal discoloration or change in gloss, no blistering, no softening, no swelling and no delaminating.

- A. Total thickness of top coat must meet chemical resistance criteria.
- B. When using multi-layer top coat system of different materials, all layers (materials) must meet chemical resistance criteria.

#### 2.3.1.6 Adhesion

Fluid-applied flooring system integrity such that delaminating between flooring system components as well as delaminating between substrate and flooring system will not occur. Test adhesion according to ASTM D4541. Adhesion failure shall be between flooring system waterproof membrane and concrete substrate at no less than 250 psi.

#### 2.3.1.7 Top Coat Finish and Appearance

Final surface appearance of flooring system must be solid color, smooth and 100 percent pit and pinhole free for ease of cleaning and decontamination. Visual inspection of topcoat with use of artificial light source directed parallel to surface to highlight pinholes and pits will be used to determine top coat finish. Provide manufacturer recommended optional sealer coat for improved UV stability, abrasion, stain and chemical resistance.

Gloss of finish: Minimum 35 units per ASTM D523 measured at 60 degree geometry. (MPI Gloss level 5, 6 or 7).

#### 2.3.1.8 Recoat Capability

System must be capable of recoating after total cure. Adhesion between existing and new top coat must be by mechanical bond (surface abrasion). Recoated system must meet original criteria.

#### 2.3.1.9 Compatibility

Provide evidence of compatibility with special coating system prior to installation of either system. (Definition: Successful installation adjacent to, and one over the other with no delaminating between or deterioration in physical characteristics.)

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verification

- A. Verify specified site conditions are established before commencing work.
- B. Verify that specified fluid-applied flooring is compatible with special coating identified for use on walls of room.

3.1.2 Moisture Content

- A. Monitor moisture content of concrete surfaces to receive fluid-applied flooring system RES5 bi-weekly beginning at the fourth month of concrete curing period.
- B. Test concrete for moisture content to ensure that it is suitable for application.

3.1.3 Existing Conditions

Ensure concrete to receive fluid-applied flooring has been provided as specified in other Sections. Ensure concrete surfaces will not adversely affect performance of fluid-applied flooring; and that concrete surfaces can be brought to acceptable condition by means of preparation specified in this Section.

3.2 IN-SITU RELATIVE HUMIDITY TESTING OF CONCRETE

3.2.1 Humidity Testing

Complete in-situ relative humidity testing at least two weeks prior to start of installation of fluid-applied flooring material. Retest if at any time between the initial test and the occurrence of the environmental conditions change (e.g., wetting of floor, excessive humidity in space to receive flooring, etc.)

3.2.2 Test Method

Test in accordance with ASTM F2170, testing at a depth of 2-inches into concrete.

- A. If a reading higher than maximum specified amount is obtained on any single sample, Contractor shall clearly highlight that result and segregate such readings in the report. Retesting may be required for slab areas which does not pass the test.
- B. Provide recommendations to remedy excess in-situ relative humidity, which could include waiting an additional period of time before retesting in the hope that the reduced slab water content will yield a decreased relative humidity. Any remedy other than a complete retest at a later time shall be approved in writing by the fluid-applied flooring manufacturer. Approval by the manufacturer must state that the proposed remedy shall have no adverse impact on the manufacturer's warranty for the completed flooring system.



### 3.2.3 Result

Proceed with installation only when in-situ relative humidity of concrete is below 75%, unless a more stringent result is recommended by the manufacturer.

### 3.2.4 Number of Tests

For floor areas greater than 4,500 sq. ft., a minimum of one test per 2,000 sq. ft. is required, unless flooring manufacturer specifies floor area less than 2,000 sq. ft. For floor areas less than 4,500 sq. ft., minimum three tests are required, unless flooring manufacturer specifies a greater number of tests.

### 3.2.5 Final Report

Prepare and submit a final report. Report shall indicate location and limits of each test area and tabulated test results. Approval is required before any resinous floor material application begins.

## 3.3 PREPARATION

### 3.3.1 General

- A. Cover or mask surfaces adjacent to those receiving fluid-applied flooring to protect work of others and property from damage and soil.
- B. Following acceptance of the concrete surfaces, fluid-applied flooring applicator shall be responsible for surface preparation not specified under work of other Sections.

### 3.3.2 Concrete Substrates

- A. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with fluid-applied flooring.
- B. Prepare concrete substrates in accordance with ASTM C811 requirements, unless manufacturer's written instructions are more stringent.
- C. Shot-blast concrete substrates with apparatus that abrades concrete surface, contains dispensed shot within apparatus, and recirculates shot by vacuum pickup. Shotblast profile shall be ICRI 03732 ICRI standard profile CSP 3 - 5. Chemically remove oil and grease not removed by mechanical methods prior to application of fluid-applied flooring.
- D. Perform In-Situ Relative Humidity Test in accordance with ASTM F1869 for concrete slabs as specified in this Section.

### 3.3.3 Repairs

Repairs with cementitious non-shrink grout, shot-blasting and grinding work may take place during the concrete curing period. Other preparations including the applications of fillers and sealers may proceed after the minimum six month concrete curing period and immediately prior to application of fluid-applied flooring materials.

### 3.3.4 Grinding and Routing

- A. Grind high spots, and fill low spots and holes
- B. Rout out control joints, other cracks and voids, and completely fill with compounds designed specifically for purpose recommended by manufacturer and compatible with flooring material. Provide a depression along the length of joints so that mesh overlay of joints does not telegraph thru to finished floor.
- C. Grind concrete substrate to allow a smooth and flush transition and/or termination of fluid-applied flooring system to other floorings or materials. Coordinate depth of grind with full thickness of fluid-applied flooring system.

### 3.4 PROTECTION

Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material

### 3.5 INSTALLATION

#### 3.5.1 Supervision

Flooring manufacturer shall continuously supervise application. Provide daily reports of installation to the AE.

#### 3.5.2 Mixing

Mix components and prepare materials according to fluid-applied flooring manufacturer's written instructions.

#### 3.5.3 Expansion Joints

Do not apply flooring over expansion or isolation joints.

#### 3.5.4 Appearance

Apply fluid-applied flooring with care to ensure that no laps, voids, or other marks or irregularities are visible, and an appearance of uniform color, sheen and texture is achieved.

#### 3.5.5 Thickness

Install mineral aggregate matrix to specified thickness and finished smooth to ensure no telegraphing through to top coat.

#### 3.5.6 Junctions

Make clean true junctions with no visible overlap between adjoining applications of fluid-applied flooring.

#### 3.5.7 Integral Cove Base

Terminate flooring cove base in manner detailed. Provide minimum 6-inch high base unless noted otherwise. Protect flooring after installation.

### 3.5.8 Floor Mounted Equipment

Install fluid-applied flooring continuous under all floor-mounted mechanical, electrical and scientific equipment, over concrete pads and into pits and trenches prior to installation of mechanical and electrical equipment. Coordinate as required with other trades.

### 3.5.9 Divider Strips

Install divider strips at junctions of fluid-applied flooring with other materials.

### 3.5.10 Door Openings

At door openings to adjacent floor finishes provide saw cut across opening. Where floorings are of different thicknesses, remove concrete on fluid applied flooring side by grinding to provide smooth transition with minimum 3/16 inch fluid applied flooring thickness through opening. At door openings to floor finishes of same thickness, provide metal divider strips flush with surfaces.

### 3.5.11 Floor Drains

At floor drains, carefully grind concrete around perimeter to provide 3/16-inch thickness of flooring material which is flush with top of drain and slopes as indicated on drawings. Provide sealant bead around perimeter of drain as detailed.

### 3.5.12 Primer

Apply primer in accordance with flooring manufacturer's specifications.

### 3.5.13 Elastomeric Waterproofing Membrane

- A. Apply waterproofing membrane in accordance with manufacturer's recommendations. Turn up wall behind base and over curbs at entrances.
- B. Apply primer to waterproofing membrane prior to installation of subsequent materials in flooring system.

### 3.5.14 Mineral Aggregate

Install mineral aggregate matrix in accordance to manufacturer's specifications.

### 3.5.15 Top Coats

- A. Apply top coat(s) to mineral aggregate matrix in accordance to manufacturer's instructions.
- B. When applying multiple coats, apply subsequent coat within manufacturer's recommended recoat window. Chemical bond between coats must be achieved. Top coat must be 100% pit and pin hole free.
- C. Where indicated or scheduled, broadcast aggregate into top coat with even distribution to obtain slip resistance quality acceptable to the AE. Provide smooth surface to coved base detail.

### 3.6 APPLICATION

Apply primer, floor surfacing, and seal coat in accordance with the manufacturer's recommendations and the following requirements.

#### 3.6.1 Floor Surfacing

Entire surfacing in any one room or area shall be placed in one continuous operation except for placement of divider strips at structural floor control joints or as indicated.

### 3.7 FIELD QUALITY CONTROL

#### 3.7.1 Flooring Manufacturer

Flooring manufacturer shall provide technical support for product installation.

#### 3.7.2 Destructive Testing - RES5

Destructive testing will be conducted after application of fluid-applied flooring. AE will designate one location per 5000 sq ft. to be tested by independent testing agency, to determine fluid-applied flooring system thickness and adhesion to substrate. Government will engage testing agency and Contractor will coordinate work.

- A. Test will be conducted as described in ASTM D4541.
- B. Acceptance criteria: as specified in Article "Fluid-Applied Flooring Schedule" of this section.
- C. Repair damage caused by destructive testing at no additional cost to Government, using manufacturer's recommended methods.
- D. For each test sample that fails to meet specification acceptance criteria take two additional samples. The cost of further testing, reports and repairs will be responsibility of Contractor.
- E. If test results show installed materials do not comply with specified requirements, remove non-complying materials and reapply flooring materials to comply with requirements at no additional cost to the Government.
- F. Reapplied flooring system will be subject to original testing requirements to confirm specification compliance.
- G. Include in bid price costs associated with performing tests, preparing reports and repairing damaged areas.

### 3.8 ALLOWABLE TOLERANCES

Finish surfaces shall be level, or straight where sloped to drains, within a tolerance of 1/16-inch in 10-feet, and shall not vary more than 1/8-inch in any running 10-feet.

### 3.9 ADJUSTMENT AND CLEANING

#### 3.9.1 Touch-Up

Touch-up and refinish minor defective work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

#### 3.9.2 Spills and Spatters

Remove promptly as work progresses spilled or spattered materials from surfaces of work performed under other Sections. Clean floors on completion of work. Do not mar surfaces while removing.

#### 3.9.3 Storage and Mixing Areas

Leave storage and mixing areas in same condition as equivalent spaces in project.

#### 3.9.4 Cleaning

Clean fluid-applied flooring not more than 4 days before dates scheduled for inspections intended to establish Beneficial Occupancy Date in each Project area. Use cleaning materials and procedures recommended in writing by fluid-applied flooring manufacturer.

### 3.10 PROTECTION

#### 3.10.1 Barriers

Erect barriers to prevent the entry and presence of personnel not performing work of this Section during application of fluid-applied flooring, and for 48 hours following completion of application.

#### 3.10.2 Protective Cover

Finished flooring shall be protected from traffic by covering with 1/8 inch thick hardboard secured in place or other equally effective means until final acceptance of the project.

-- End of Section --

SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION  
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2021) Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A135/A135M	(2021) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings

FM GLOBAL (FM)

FM 1637	(2010) Flexible Sprinkler Hose with Threaded End Fittings
FM APP GUIDE	(updated on-line) Approval Guide <a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a>

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### MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71 (2018) Gray Iron Swing Check Valves,  
Flanged and Threaded Ends

### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2022; ERTA 1 2021) Standard for the  
Installation of Sprinkler Systems

NFPA 13R (2022) Standard for the Installation of  
Sprinkler Systems in Low-Rise Residential  
Occupancies

NFPA 24 (2022) Standard for the Installation of  
Private Fire Service Mains and Their  
Appurtenances

NFPA 101 (2021) Life Safety Code

NFPA 291 (2022) Recommended Practice for Fire Flow  
Testing and Marking of Hydrants

### NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (2012) Program Detail Manual for  
Certification in the Field of Fire  
Protection Engineering Technology (Field  
Code 003) Subfield of Automatic Sprinkler  
System Layout

### UNDERWRITERS LABORATORIES (UL)

UL 199 (2020) UL Standard for Safety Automatic  
Sprinklers for Fire-Protection Service

UL 312 (2010; Reprint Mar 2018) UL Standard for  
Safety Check Valves for Fire-Protection  
Service

UL 668 (2004; Reprint Oct 2021) UL Standard for  
Safety Hose Valves for Fire-Protection  
Service

UL 2443 (2015; Reprint May 2020) UL Standard for  
Safety Flexible Sprinkler Hose with  
Fittings for Fire Protection Service

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

## 1.2 SYSTEM DESCRIPTION

Provide wet pipe sprinkler system(s) in . Except as modified herein, the system must meet the requirements of NFPA 13. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

### 1.2.1 Hydraulic Design

#### 1.2.1.1 Basis for Calculations

A waterflow test was performed on July 2010 at the existing service main and resulted in a static pressure of 63 psi with a residual pressure of 60 psi while flowing 1449 gpm. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on a new flow test verified by the Fire Protection Engineer and approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping. Hydraulic calculations must be based on operation of the existing installed fire pumps at the south of the building.

#### 1.2.1.2 Hydraulic Calculations

- a. Water supply curves and system requirements must be plotted on semi-logarithmic graph ( $N^{1.85}$ ) paper so as to present a summary of the complete hydraulic calculation.
- b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.
- c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.
- d. Where the sprinkler system is supplied by interconnected risers, the sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.
- e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow.
- f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.
- g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

#### 1.2.1.3 Design Criteria

Hydraulically design the system to discharge a minimum density as indicated on the drawings. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior and interior hose streams as identified on drawings.



### 1.2.2 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the area noted on the Contract drawings. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13. Exceptions are as follows:

- a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.
- b. Facilities that are designed in accordance with NFPA 13R.

### 1.2.3 Qualified Fire Protection Engineer (QFPE)

An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

- a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.
- b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting all outstanding comments.
- c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).
- d. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.
- e. Signing applicable certificates under SD-07.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to

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submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE must be returned disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE); G

Sprinkler System Designer; G

Sprinkler System Installer; G

### SD-02 Shop Drawings

Shop Drawing; G

### SD-03 Product Data

Pipe; G

Fittings; G

Valves, including gate, check, butterfly, and globe; G

Sprinklers; G

Pipe Hangers and Supports; G

Sprinkler Alarm Switch; G

Valve Supervisory (Tamper) Switch; G

Hose Valve; G

Seismic Bracing; G

Nameplates; G

### SD-05 Design Data

Seismic Bracing; G

Load calculations for sizing of seismic bracing

Hydraulic Calculations; G

### SD-06 Test Reports

Test Procedures; G

### SD-07 Certificates

Verification of Compliant Installation; G

Request for Government Final Test; G

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions; G

Spare Parts Data; G

SD-11 Closeout Submittals

As-built drawings

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved Without Review.

##### 1.4.1.1 Shop Drawing

Four copies of the shop drawings, no later than 28 days prior to the start of system installation. Working drawings conforming to the requirements prescribed in NFPA 13 and must be no smaller than the Contract Drawings. Each set of drawings must include the following:

- a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
- b. Floor plans drawn to a scale not less than 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, and other details required to clearly describe the proposed arrangement.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross mains and branch lines to finished floor and roof or ceiling. A detail must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.
- e. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.
- f. Riser layout drawings drawn to a scale of not less than 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
- g. Details of each type of riser assembly, pipe hanger, sway bracing for earthquake protection, and electrical devices and interconnecting

wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.

- h. Details of each type of pipe hanger, seismic bracing/restraint and related components.
- i. Include fire pump curve with shop drawings and hydraulic calculations.

#### 1.4.1.2 Product Data

Four copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

#### 1.4.1.3 Hydraulic Calculations

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Calculations must include isometric diagram indicating hydraulic nodes and pipe segments. Include fire pump curve with submittal.

#### 1.4.1.4 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide six manuals and one pdf version on electronic media. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted must be capable of providing 8-hour on-site response to a service call on an emergency basis.

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1-year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

#### 1.4.2 Qualifications

##### 1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

##### 1.4.2.2 Sprinkler System Installer

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at

least three systems that have performed in the manner intended for a period of not less than 6 months.

#### 1.4.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of an item or equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation are mandatory requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

#### 1.6 EXTRA MATERIALS

Spare sprinklers and wrench(es) must be provided as spare parts in accordance with NFPA 13.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

##### 2.1.1 Standard Products

Provide materials, equipment, and devices listed for fire protection service when so required by NFPA 13 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for a classification of material. Material and equipment must be standard products of a manufacturer regularly engaged in the manufacture of the products for at least 5 years prior to bid.

##### 2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

##### 2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

## Repair Steam Sterilization Plant (SSP)

### 2.1.4 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than 250 psi.

## 2.2 ABOVEGROUND PIPING COMPONENTS

### 2.2.1 Steel Piping Components

#### 2.2.1.1 Steel Pipe

Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M or ASTM A153/A153M.

Steel pipe must be Schedule 40 only.

#### 2.2.1.2 Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted. Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound. Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe. Reducing couplings are not permitted except as allowed by NFPA 13.

#### 2.2.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 250 psi service and the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 2 inches and larger. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

#### 2.2.1.4 Flanges

Flanges must conform to NFPA 13 and ASME B16.1. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1/16-inch thick, and full face or self-centering flat ring type.

### 2.2.2 Flexible Sprinkler Hose

The use of flexible hose is permitted only in lay-in acoustical grid ceilings. Flexible sprinkler hose must comply with UL 2443 and FM 1637.

### 2.2.3 Pipe Hangers and Supports

Provide galvanized pipe hangers, supports and seismic bracing in

## Repair Steam Sterilization Plant (SSP)

accordance with NFPA 13. Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes".

### 2.2.4 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

#### 2.2.4.1 Control Valve

Manually operated sprinkler control/gate valve must be outside stem and yoke (OS&Y) type and must be listed.

#### 2.2.4.2 Check Valves

Check valves must comply with UL 312. Check valves 4 inches and larger must be of the swing type, have a clear waterway and meet the requirements of MSS SP-71, for Type 3 or 4. Inspection plate must be provided on valves larger than 6 inches.

#### 2.2.4.3 Hose Valve

Valve must comply with UL 668.

### 2.3 ALARM INITIATING AND SUPERVISORY DEVICES

#### 2.3.1 Sprinkler Alarm Switch

Vane or pressure-type flow switch(es). Connection of switch must be by the fire alarm installer. Vane type alarm actuating devices must have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and must instantly recycle.

#### 2.3.2 Valve Supervisory (Tamper) Switch

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

### 2.4 SPRINKLERS

Sprinklers must comply with UL 199 and NFPA 13. Sprinklers with internal O-rings are not acceptable. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters must have temperature classification in accordance with NFPA 13. Extended coverage sprinklers are permitted for loading docks, residential occupancies and high-piled storage applications only.

#### 2.4.1 Pendent Sprinkler

Pendent sprinkler must be recessed quick-response type with nominal K-factor of 5.6 or 8.0 as indicated on drawings. Pendent sprinklers must have a polished chrome or white polyester finish as indicated on drawings. Assembly must include an integral escutcheon.

#### 2.4.2 Upright Sprinkler

Upright sprinkler must be brass quick-response type and have a nominal K-factor of 5.6 or 8.0 as indicated on drawings.

### 2.5 ACCESSORIES

#### 2.5.1 Sprinkler Cabinet

Provide spare sprinklers in accordance with NFPA 13 and must be placed in a suitable metal or plastic cabinet of sufficient size to accommodate all the spare sprinklers and wrenches in designated locations. Spare sprinklers must be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed as required by NFPA 13. At least one wrench of each type required must be provided.

#### 2.5.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 3/4-inch and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

#### 2.5.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

#### 2.5.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located within 7 feet of the floor.

#### 2.5.5 Identification Sign

Valve identification sign must be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gage steel or 0.024-inch aluminum with red letters on a white background or white letters on red background. Wording of sign must include, but not be limited to "main drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components. Where there is more than one sprinkler system, signage must include specific details as to the respective system.

## PART 3 EXECUTION

### 3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative a condition that prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.



### 3.2 INSTALLATION

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

- a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.
- b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) that are concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.
- c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

#### 3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash which may have accumulated during the day as a result of work by the contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities, and property.

### 3.3 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

#### 3.3.1 Protection of Piping Against Earthquake Damage

Seismic restraint is required.

#### 3.3.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

#### 3.3.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping must be inspected, hydrostatically tested and approved before being

concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

#### 3.3.4 Pendent Sprinklers

- a. Drop nipples to pendent sprinklers must consist of minimum 1-inch pipe with a reducing coupling into which the sprinkler must be threaded.
- b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.
- c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.
- d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (plus or minus 2 inches).
- e. Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 12 inches for steel pipe.

#### 3.3.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

#### 3.3.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints must be provided where indicated or required by NFPA 13. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

#### 3.3.7 Reducers

Reductions in pipe sizes must be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings cannot be used in

elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2-inch.

### 3.3.8 Pipe Penetrations

- a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.
- b. Where pipes and sleeves penetrate fire walls, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.
- c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

### 3.3.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

### 3.3.10 Drains

- a. Auxiliary drains must be provided as required by NFPA 13. Auxiliary drains are permitted to discharge to a floor drain if the drain is sized to accommodate full flow (min 40 gpm). Discharge to service sinks or similar plumbing fixtures is not permitted.

### 3.3.11 Identification Signs

Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Main drain test results must be etched into main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 inches in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75-inch in height and visible from the floor.

## 3.4 ELECTRICAL

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.

### 3.5 PAINTING

Color code mark piping as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.6 FIELD QUALITY CONTROL

#### 3.6.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level IV Fire Sprinkler Technician, and the representative of the installing company, and reviewed by the QFPE 60 days prior to performing system tests. Detailed test procedures must list all components of the installed system. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13). The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government final testing.

- a. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

#### 3.6.2 Pre-Government Testing

##### 3.6.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13. The Contractor and QFPE must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

- a. NFPA 13 Aboveground Material and Test Certificate

##### 3.6.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the Designated Fire Protection Engineer (DFPE). Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the building fire alarm system have been completed and tested to confirm communications are fully functional. Submit request for test at least 15 calendar days prior to the requested test date.

#### 3.6.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must be conducted and repeated if necessary until the system has been

demonstrated to comply with all contract requirements.

#### 3.6.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

- a. The manufacturer's technical representative.
- b. The contractor's Qualified Fire Protection Engineer (QFPE).
- c. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the Designated Fire Protection Engineer or Qualified Fire Protection Engineer (QFPE). At this time, all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

#### 3.7 MINIMUM SYSTEM TESTS

The system, including the underground water mains, and the aboveground piping and system components, must be tested to ensure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13 and NFPA 24.

##### 3.7.1 Aboveground Piping

###### 3.7.1.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

##### 3.7.2 Main Drain Flow Test

Following flushing of the underground piping, a main drain test must be made to verify the adequacy of the water supply. Static and residual pressures must be recorded on the certificate specified in paragraph SUBMITTALS.

#### 3.8 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final acceptance test.

- a. Provide one set of full size paper as-built drawings and schematics. The drawings must be prepared electronically and sized no less than the contract drawings. Furnish one set of CDs or DVDs containing

software back-up and CAD based drawings in latest version of AutoCAD, DXF and portable document formats of as-built drawings and schematics.

- b. Provide operating and maintenance (O&M) instructions.

### 3.9 ONSITE TRAINING

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of 4 hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE  
04/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- |           |   |
|-----------|---|
| AWWA B300 | (2018) Hypochlorites  |
| AWWA B301 | (2018) Liquid Chlorine  |
| AWWA C203 | (2020) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- |                  |  |
|------------------|--|
| ASME A112.36.2M  | (1991; R 2017) Cleanouts   |
| ASME A112.6.1M   | (1997; R 2017) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use |
| ASME B1.20.1     | (2013; R 2018) Pipe Threads, General Purpose (Inch)                                      |
| ASME B31.1       | (2020) Power Piping  |
| ASME B40.100     | (2013) Pressure Gauges and Gauge Attachments   |
| ASME BPVC SEC IX | (2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications           |

ASTM INTERNATIONAL (ASTM)

- |                   |  |
|-------------------|--|
| ASTM B117         | (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus                          |
| ASTM B370         | (2012; R 2019) Standard Specification for Copper Sheet and Strip for Building Construction |
| ASTM C920         | (2018) Standard Specification for Elastomeric Joint Sealants                               |
| ASTM D2822/D2822M | (2005; R 2011; E 2011) Standard Specification for Asphalt Roof Cement,                     |

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### Asbestos-Containing

ASTM E1	(2014) Standard Specification for ASTM Liquid-in-Glass Thermometers
U.S. DEPARTMENT OF DEFENSE (DOD)	
UFC 3-420-01	(2021) Plumbing Systems
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IPC	(2018) International Plumbing Code
NACE INTERNATIONAL (NACE)	
NACE SP0169	(2013) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 90A	(2021) Standard for the Installation of Air Conditioning and Ventilating Systems
NSF INTERNATIONAL (NSF)	
NSF/ANSI 14	(2020) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2020) Drinking Water System Components - Health Effects
PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)	
PPFA Fire Man	(2016) Firestopping: Plastic Pipe in Fire Resistive Construction
PLUMBING AND DRAINAGE INSTITUTE (PDI)	
PDI WH 201	(2010) Water Hammer Arresters Standard
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE J1508	(2009) Hose Clamp Specifications
U.S. DEPARTMENT OF ENERGY (DOE)	
PL 93-523	(1974; A 1999) Safe Drinking Water Act
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
PL 102-486	(1992) Residential Energy Efficiency Ratings

### 1.2 APPLICATION OF THIS SECTION

This Section applies to all Sections in Division 22 as the work is applicable.



### 1.3 SECTION INCLUDES

- A. General requirements for Plumbing work including:
  - 1. Arrangement of work and layout intent.
  - 2. Quality assurance.
  - 3. Definitions.
  - 4. Regulatory requirements.
  - 5. Access door coordination.
- B. Pipe installation procedures. Piping materials are specified under piping systems specifications.
- C. Valves.
- D. Piping Accessories.
- E. Pipe sleeves and seals.
- F. Electrical equipment and wiring.
- G. Accessories materials.
- H. Housekeeping pads and other miscellaneous concrete work.
- I. Roof penetration counterflashing.

### 1.4 REFERENCE SPECIFICATIONS

Unless Specified Otherwise, follow:

- A. Coordination of space, spacing of inserts and load limitation procedures of Section 01 31 11 SUSPENDED LOADING - COORDINATION AND LIMITATIONS.
- B. Material and installation procedures of Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE for cast-in-place concrete work.
- C. Material and installation procedures of Section 07 71 00 ROOF SPECIALTIES AND ACCESSORIES for counterflashing of mechanical roof penetrations.

### 1.5 RELATED SECTIONS

- A. Section 01 42 13 - REFERENCE STANDARDS, ABBREVIATIONS AND DEFINITIONS, for definitions of various building spaces.
- B. Section 07 84 00 - FIRESTOPPING, for firestopping at fire rated construction.
- C. Section 07 92 00 - JOINT SEALANTS, for joint sealers at non-fire rated construction.
- D. Section 09 90 00 - PAINTS AND COATINGS, for field painting of plumbing work.
- E. Section 22 05 19 PLUMBING THERMOMETERS AND GAUGES
- F. Section 22 05 29 PLUMBING HANGERS AND SUPPORTS

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- G. Section 22 05 33 PLUMBING HEAT TRACING SYSTEM (FREEZE PROTECTION)
- H. Section 22 05 48 PLUMBING SOUND, VIBRATION, AND SEISMIC CONTROL
- I. Section 22 05 53 PLUMBING IDENTIFICATION
- J. Section 22 05 75 DRAINS AND CLEANOUTS
- K. Section 22 07 00 THERMAL INSULATION FOR PLUMBING SYSTEMS
- L. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS
- M. Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS
- N. Section 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES
- O. Section 22 10 19 PLUMBING, PIPING SPECIALTIES
- P. Section 22 11 23 WATER PRESSURE BOOSTER SYSTEM
- Q. Section 22 14 29 WASTEWATER PUMP
- R. Section 22 15 19.19 NONLUBRICATED ROTARY SCREW AIR COMPRESSORS
- S. Section 22 31 00 WATER SOFTENERS, CATION-EXCHANGE (SODIUM CYCLE)
- T. Section 22 33 00 WATER HEATERS
- U. Section 22 33 30.00 10 SOLAR WATER HEATING EQUIPMENT
- V. Section 22 36 00 CHEMICAL SHOWER SYSTEM
- W. Section 22 42 00 COMMERCIAL PLUMBING FIXTURES
- X. Section 22 62 16 LABORATORY GAS AND VACUUM SYSTEM
- Y. Section 22 63 17 LIQUID NITROGEN SYSTEM
- Z. Section 22 64 00 BREATHING AIR SYSTEMS
- AA. Section 22 67 00 PURIFIED WATER GENERATING EQUIPMENT (REVERSE OSMOSIS WATER SKID/TANKS)
- BB. Section 22 71 00 AUTOMATIC ANIMAL WATERING SYSTEMS
- CC. Section 22 72 00 DETERGENT TRANSFER SYSTEM
- DD. Section 31 00 00 - EARTHWORK, for earthwork for underground utilities.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G, AE

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Plumbing System; G, AE

Plumbing Fixtures: Technical sheets with indication of manufacturers, models and flow rates if applicable, etc.

Plumbing Equipment: Technical sheets with indication of manufacturers, models, capacities and electric requirements, etc.

Plumbing Piping Materials: Technical sheets with indication of manufacturers, including pipes, pipe fittings and valves, etc.

Plumbing Specialties: Technical sheets with indication of manufacturers, models and capacities, etc.

Local/Regional Materials

Documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

Environmental Data

Materials

Documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Backflow prevention assemblies; G, AE

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features; G, AE

## Repair Steam Sterilization Plant (SSP)

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

### SD-06 Test Reports

Tests, Flushing and Disinfection; G

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

### SD-07 Certificates

Materials and Equipment

Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements.

### SD-10 Operation and Maintenance Data

Plumbing System; G, AR

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

### 1.7 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years, or as otherwise indicated in individual specification sections, prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

#### 1.7.1 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### 1.7.2 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 1.7.3 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

##### 1.7.3.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." References to the "permit holder" shall be interpreted to mean the "Contractor."

##### 1.7.3.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

#### 1.9 PERFORMANCE REQUIREMENTS

##### 1.9.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators

qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Refer to section 40 17 26.00 WELDING PRESSURE PIPING for additional welding, examination and testing criteria.

#### 1.9.2 Plumbing Fixtures

Water flow and consumption rates shall at a minimum comply with requirements in PL 102-486.

#### 1.10 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with the following:

- A. International Building Code ICC IBC.
- B. International Plumbing Code ICC IPC.
- C. National Board Inspection Code (NBBP).
- D. National Electrical Code (NEC) NFPA 70, including amendments by local Authority having jurisdiction.
- E. United Facilities Criteria - Plumbing System UFC 3-420-01.

#### 1.11 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

#### 1.12 INSTRUCTION TO GOVERNMENT PERSONNEL

- A. When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.
- B. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.
- C. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

### 1.13 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, and equipment requiring access, in locations freely accessible through access doors.

### 1.14 ARRANGEMENT OF WORK AND LAYOUT INTENT

- A. Drawings are diagrammatic and indicate general arrangements, approximate sizes and relative locations of principal elements. Provide offsets as required for coordinated installation. Provide equipment, materials and methods not shown or specified, but required to complete the work.
- B. In finished spaces, conceal work within walls or chases. At suspended ceilings, conceal work above ceiling unless indicated otherwise.
- C. In finished spaces with or without ceilings, coordinate with other work.
- D. In finished spaces without ceilings, and unless shown otherwise, install work in most direct manner, parallel with building lines.
- E. Where physical interference cannot be readily resolved, prepare composite drawings at a scale of 1/4 inch equals 1 foot or larger. Show this work in relation to other work. Obtain written approval of proposed changes. Distribute drawings to other parties affected.
- F. Subject to approval, provide modifications in layout as required to prevent conflict with other work or for proper execution.
- G. Do not install piping, equipment foreign to elevator equipment in elevator machine rooms.
- H. Do not install piping, or equipment foreign to electrical equipment in electrical equipment rooms or telecommunication closets.
- I. Do not install piping over, around, in front of, in back of, or below electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip pans are not permitted.
- J. Do not install equipment or piping over electric panels and switch boards. Follow NEC requirements.
- K. Do not allow equipment or piping to infringe upon working clearances required by NEC.
- L. Position mechanical work for easy unobstructed maintenance access and operation.
- M. Coordinate equipment layouts with other work to determine roughing-in requirements. Do not scale drawings for dimension. Neatly arrange work, and in such manner overcome local interference to best advantage of the Project.
- N. Do not install aluminum or copper products where they will be encased in concrete.

1.15 QUALITY ASSURANCE

- A. American National Standards Institute (ANSI).
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
- C. American Society of Mechanical Engineers (ASME).
- D. American Society of Sanitary Engineers (ASSE).
- E. American Society for Testing and Materials (ASTM).
- F. American Welding Society (AWS).
- G. American Water Works Association (AWWA).
- H. Cast Iron Soil Pipe Institute (CISPI).
- I. Compressed Gas Association (CGA).
- J. Copper Development Association (CDA).
- K. Ductile Iron Pipe Research Association (DIPRA).
- L. Factory Insurance Association (FIA).
- M. Factory Mutual System (FM).
- N. Industrial Risk Insurance (IRI).
- O. Manufacturers Standardization Society of Valve and Fitting Industry (MSS).
- P. National Electrical Manufacturers Association (NEMA).
- Q. National Environmental Balancing Bureau (NEBB).
- R. National Fire Protection Association (NFPA).
- S. National Sanitation Foundation (NSF).
- T. National Solid Wastes Management Association (NSWMA).
- U. Underwriters Laboratories Inc. (UL): All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL Standards are approved, provided equipment and materials are listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive submittals.
- V. Pressure vessels and safety devices shall be listed and certified in accordance with ASME Test Code.



## 1.16 DEFINITIONS

### 1.16.1 Listed

Equipment is "listed" if of a kind mentioned in a list which:

- A. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
- B. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

### 1.16.2 Labeled

Equipment is "labeled" if:

- A. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
- B. Production is periodically inspected by a nationally recognized testing laboratory.
- C. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

### 1.16.3 Certified

Equipment is "certified" if:

- A. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
- B. Production is periodically inspected by a nationally recognized testing laboratory.
- C. It bears a label, tag, or other record of certification.

### 1.16.4 Nationally recognized Testing Laboratory

A testing laboratory which complies with OSHA regulations.

## 1.17 ACCESS DOOR COORDINATION

- A. In general, arrange work so access doors are not required. Where mechanical devices requiring access must be concealed in finished construction, coordinate with other trades and submit schedule showing size and location of each door.
- B. Where doors are required, follow Section 08 31 13 ACCESS DOORS.

## 1.18 SUSTAINABLE DESIGN REQUIREMENTS

### 1.18.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available

from a minimum of three sources.

#### 1.19 MOCK-UPS

Provide products and installation as specified in Division 22 Sections for in-place mock-ups specified in Section 01 45 10.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Materials for various services shall be specified in Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS and 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Polypropylene pipe and fittings shall conform to dimensional requirements of SDR 11 which defines the wall thickness in respect to the outside diameters. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground. Plastic pipe shall not be installed in air plenums.

##### 2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Pipe Joint material for various services shall be specified in Sections 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS and 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES.

##### 2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- A. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be diaphragm type.
- B. Copper, Sheet and Strip for Building Construction: ASTM B370.
- C. Asphalt Roof Cement: ASTM D2822/D2822M.
- D. Hose Clamps: SAE J1508.
- E. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- F. Metallic Cleanouts: ASME A112.36.2M.
- G. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be

nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

- H. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- I. Hypochlorites: AWWA B300.
- J. Liquid Chlorine: AWWA B301.
- K. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- L. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

#### 2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 22 07 00 THERMAL INSULATION FOR PLUMBING SYSTEMS.

#### 2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe supports shall be as specified in Section 22 05 29 PLUMBING HANGERS AND SUPPORTS.

#### 2.3 VALVES

Valves for various services shall be specified under Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS and 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES.

#### 2.4 ELECTRICAL WORK

##### 2.4.1 Motors

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure. Follow Section 26 60 13 LOW-VOLTAGE MOTORS.

##### 2.4.2 Motor Starting Equipment

- A. Unless otherwise specified, motor control centers, single and three phase starters and disconnect switches are specified under Division 26.
- B. Provide disconnect switches, magnetic motor starters and combination disconnect switches and starters which are an integral part of packaged equipment specified in Division 22. Comply with requirements of Division 26.

##### 2.4.3 Wiring and Conduit

Follow Division 26.

- A. Unless otherwise specified, power wiring from power source to motor

starting equipment including variable frequency drive packages and from that equipment to motors including final connections is specified under Division 26.

- B. Wiring up to 120 volt from control panels to control(led) devices is classified as control wiring.
- C. Factory install power wiring from control(led) devices, motors and equipment to factory mounted starting equipment specified under Division 26. Wherever possible, factory install control wiring.
- D. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### 2.4.4 Control Panels

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

##### 2.4.4.1 ATC Control Panels

Follow Division 23.

##### 2.4.4.2 Packaged Equipment Control Panels

Assemble and wire with electrical equipment, interlocks, interconnections and controls. Design panels for only one incoming field feed connection.

##### 2.4.4.3 Other Panels

NEMA 1 general purpose enclosure for interior locations; NEMA 3R weather resistant enclosure for exterior location or when otherwise exposed to moisture.

##### 2.4.4.4 Accessories

- A. Internal Circuit Protection: For each motor, control circuit, electric heater and other circuits requiring protection.
- B. Control Transformers: Where required to operate at 120V AC maximum.
- C. Terminal Strips: Mounted within enclosure arranged for conduit entry.

##### 2.4.4.5 Equipment Control

Factory mount and wire devices required for equipment control

##### 2.4.4.6 Wire Control Panels

Wire control panels so that only one switched field power connection is required.

## Repair Steam Sterilization Plant (SSP)

### 2.4.5 Identification

Follow Section 22 05 53 PLUMBING IDENTIFICATION.

### 2.4.6 Electrical Characteristics

Verify that electrical characteristics of equipment furnished under this Division are in conformance with electrical services shown or specified.

### 2.4.7 Design Modifications

When proposed products differ from design standard in size, characteristics or capacity, notify all concerned parties in writing of such proposed changes, listing related items of work affected by change.

## 2.5 MISCELLANEOUS PIPING ITEMS

### 2.5.1 Piping Accessories

#### 2.5.1.1 Conditions

Do not use gaskets or packing containing asbestos.

#### 2.5.1.2 Escutcheons

Provide one piece, set screw type for entering floors, walls and ceilings in exposed spaces. Provide chrome plated on copper alloy plates or stainless steel finish in finished spaces; cast brass in unfinished; none required in concealed areas. No escutcheons shall be provided in high containment areas. Details on drawings for pipe penetration in the area shall be strictly followed.

### 2.5.2 Pipe Sleeves and Seals

Pipe sleeves shall be furnished and set in their proper and permanent location. Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material. Seal voids between sleeves and floor or wall construction to maintain seal or fire rating.

#### 2.5.2.1 Pre-fabricated Engineered Sleeves

- A. Exterior Walls and Floors (Non Fire Rated) Sleeves: Plastic Sleeve or Galvanized Steel Sleeve with or without anchor collar/water stop.
- B. Seals: Modular, mechanical type, multiple interlocking synthetic rubber, expandable links matched for sleeve assembly.
  - 1. For Standard Service Applications (minus 40 to 250 degrees F): EPDM.
  - 2. For High Temperature or Fire Seal Applications (minus 67 to 400

degrees F): Silicone.

#### 2.5.2.2 Interior-to-Interior Sleeves (Walls)

Fire rated and non-fire rated construction; steel pipe or 18 gauge galvanized steel.

#### 2.5.2.3 Floor and Roof Sleeves

Steel pipe with welded-on collar to position top of sleeve 2 inches above floor slab, and 8 inches above roof deck. Make bottom of sleeve flush with underside of roof or floor deck. Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. Engineered sleeve may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete and masonry wall as specified above. Space sleeves in concrete a minimum of 4 inches apart. Where gypsum board is installed on one side of stud partition only, provide additional sleeve support as required. Sealant selected for the earth side of the wall shall be compatible with damp proofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING. For escutcheons, install plates tight to wall or ceiling surface.

#### 2.5.2.4 Size (ID)

1/2 inch to 3/4 inch larger than penetrating element, including pipe insulation.

#### 2.5.3 Accessory Materials

##### 2.5.3.1 Anchors/Sleeves

Hook type anchor bolts with pipe sleeves of size and length to suit the need. Make sleeves one inch larger than bolt diameter and half imbedded length of bolt, to allow for lateral adjustment.

##### 2.5.3.2 Concrete Reinforcing (Housekeeping Pads)

Follow Division 03.

#### 2.5.4 Nameplates

Follow Section 22 05 53 PLUMBING IDENTIFICATION

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

##### 3.1.1 Flowable Fill

Flowable fill is required around all underground utilities which carry fluids (both exterior and below building. Follow Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE and details on drawing P5.24.

##### 3.1.2 Pipe Installation Procedures

Refer to Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS.

##### 3.1.2.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

##### 3.1.2.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

### 3.1.2.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

### 3.1.2.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of all-thread (close) nipples, swaged nipples, or busing reducer will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Obtain approval on location of such items before installation. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

### 3.1.2.5 Pipe Drains

At all low points, provide 3/4 inch gate valve with plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

### 3.1.2.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer. Sufficient pipe movement



allowance shall be made at building expansion joint lines (col. WP and EA, E13 and E14, W18 and W19) by providing expansion joint or expansion loop. If expansion loops are provided, the line that requires the largest leg must be located on the outside of the loop. Leave sufficient space around to allow for piping expansion.

#### 3.1.2.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

#### 3.1.3 Dissimilar Pipe Materials

- A. Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.
- B. Isolate non-ferrous piping passing through openings in structural steel with non-conductive material permanently attached to the pipe.

#### 3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. . Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

#### 3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

### 3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete and masonry wall as specified above. Furnish sleeves to other Sections for installation in walls at piping penetrations. Space sleeves in concrete a minimum of 4 inches apart. Where gypsum board is installed on one side of stud partition only, provide additional sleeve support as required. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING. At exterior walls and floors, install mechanical seals around pipe, in such manner to ensure watertight installation.

### 3.1.5.2 Escutcheons

Install plates tight to wall or ceiling surface.

#### 3.1.5.3 High Containment Areas

For pipe penetration in high containment areas, refer to Plumbing drawings for additional requirements.

#### 3.1.5.4 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

#### 3.1.5.5 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

#### 3.1.5.6 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- A. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- B. A tack-welded or banded-metal rain shield around the pipe.

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### 3.1.5.7 Roof Penetration Counterflashing

When roof mounted work is not furnished with integral counterflashing, provide metal counterflashing as specified under Section 07 71 00 ROOF SPECIALTIES AND ACCESSORIES.

### 3.1.5.8 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

### 3.1.5.9 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

### 3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

### 3.1.7 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used. Refer to section 40 17 26.00 WELDING PRESSURE PIPING for additional welding criteria.

### 3.1.8 Pipe Cleanouts

Refer to Section 22 05 75 DRAINS AND CLEANOUTS

### 3.1.9 Water Treatment Equipment

The successful contractor shall obtain site water report. Submitting equipment shop drawings means that contractor has verified that the site water quality meets equipment manufacturer's requirement.

## 3.2 VALVE INSTALLATION PROCEDURES

Follow Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS.

### 3.3 ELECTRICAL EQUIPMENT AND WIRING

Follow Division 26.

- A. Unless otherwise specified, install wire in conduit.
- B. Install control wiring for products under this Division except as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
- C. Where equipment is furnished without factory mounted control panels or motor starting equipment, install internal control and power wiring to terminal junction or control boxes at one location for connection of field wiring.

### 3.4 HOUSEKEEPING PADS

- A. Provide concrete pads for floor mounted mechanical equipment in dimensions indicated, if thickness is not indicated provide 4 inches thick, and extending 4 inches beyond supported equipment outline, including skids when appropriate. Equipment with support skids smaller than equipment outline are not exempt from these requirements.
- B. Coordinate interface between pad and vibration isolation bases specified in Section 22 05 48 PLUMBING SOUND, VIBRATION, AND SEISMIC CONTROL, and inserts specified in Section 22 05 29 PLUMBING HANGERS AND SUPPORTS.
- C. Use equipment manufacturer's setting templates for anchor locations. If manufacturer does not provide anchor locations, provide anchorage in compliance with International Building Code.
- D. Roughen base slab to remove existing finish and to ensure mechanical bond.
- E. Place concrete and install wire mesh one inch below finished surface.
- F. Apply hand trowel finish as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.
- G. The following equipment does not require housekeeping pads:
  - 1. In-line pumps with floor stand.
  - 2. Equipment intended to be mobile; provided with wheels or casters.
  - 3. Temporary equipment such as chemical storage tanks.

### 3.5 MISCELLANEOUS CONCRETE WORK

Provide concrete thrust blocks and other miscellaneous concrete work required for mechanical construction.

### 3.6 BACKFLOW PREVENTION DEVICES

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance, and at any water branch going into high containment areas. In addition backflow preventers shall be installed at all

locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit. Provide backflow preventer on every water supply branch which runs into high containment areas.

### 3.7 ACCESS PANELS

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 08 31 13 ACCESS DOORS.

### 3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

### 3.9 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Follow Section 22 05 48 PLUMBING SOUND, VIBRATION, AND SEISMIC CONTROL

### 3.10 IDENTIFICATION SYSTEMS

Follow Section 22 05 53 PLUMBING IDENTIFICATION.

#### 3.10.1 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.11 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew. Escutcheons shall not be used in vivarium, ABSL-3E, BSL-3E and BSL-4 spaces. Refer to particular detail shown on drawings for installation requirements.

### 3.12 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

#### 3.12.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

##### 3.12.1.1 Factory Painting Systems

- A. Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.
- B. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

##### 3.12.1.2 Shop Painting Systems for Metal Surfaces

- A. Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.
- B. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.
  - 1. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

### 3.13 PIPING COMPONENTS, PLUMBING FIXTURES AND EQUIPMENT

Do not reuse used components or materials.

### 3.14 TESTS, FLUSHING AND DISINFECTION

#### 3.14.1 Plumbing System

Refer to Piping Schedules in Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS and Section 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES for requirements for testing, flushing and disinfection.

#### 3.14.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

#### 3.14.3 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Coordinate operational test and equipment installation with commissioning as specified in Section 01 91 00 COMMISSIONING and 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- A. Time, date, and duration of test.
- B. Water pressures at the most remote and the highest fixtures.
- C. Operation of each fixture and fixture trim.
- D. Operation of each valve and faucet.
- E. Pump suction and discharge pressures.
- F. Temperature of each domestic hot-water supply.
- G. Operation of each floor and roof drain by flooding with water.
- H. Operation of each vacuum breaker and backflow preventer.
- I. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- J. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

#### 3.14.4 Disinfection

Refer to Section 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES for systems to be disinfected and procedures.



### 3.15 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

### 3.16 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

-- End of Section --

SECTION 22 10 05

BUILDING SERVICES AND PROCESS PIPING SYSTEMS

09/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4 (2015; R 2020) Relief Valves for Hot Water Supply Systems

ANSI Z21.45 (1995) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2020) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

ASSE 1005 (1999) Water Heater Drain Valves 3/4 Inch Size

ASSE 1018 (2001; R 2021) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606 (2015) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2019) Specification for Filler Metals for Brazing and Braze Welding

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.14.1 (2003; R 2017) Backwater Valves

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ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2018) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.5	(2020) Refrigeration Piping and Heat Transfer Components
ASME BPVC	(2010) Boiler and Pressure Vessels Code
ASME CSD-1	(2021) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2021) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A74	(2021) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM B32	(2020) Standard Specification for Solder Metal

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ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM C564	(2020a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2564	(2020) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2657	(2007; R 2015) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3138	(2004; R 2016) Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(2019) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F1290	(2019) Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F477	(2014; R 2021) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
CAST IRON SOIL PIPE INSTITUTE (CISPI)	
CISPI 310	(2012) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
COPPER DEVELOPMENT ASSOCIATION (CDA)	
CDA A4015	(2016; 14/17) Copper Tube Handbook
HYDRAULIC INSTITUTE (HI)	
HI SCRRP	(1994) Standards for Centrifugal, Rotary and Reciprocating Pumps

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U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-420-01 (2021) Plumbing Systems

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

ICC IPC (2018) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded,  
Socket-Welding, Solder Joint, Grooved and  
Flared Ends

MSS SP-25 (2018) Standard Marking System for Valves,  
Fittings, Flanges and Unions

MSS SP-67 (2017; Errata 1 2017) Butterfly Valves

MSS SP-70 (2011) Gray Iron Gate Valves, Flanged and  
Threaded Ends

MSS SP-71 (2018) Gray Iron Swing Check Valves,  
Flanged and Threaded Ends

MSS SP-72 (2010a) Ball Valves with Flanged or  
Butt-Welding Ends for General Service

MSS SP-73 (2003) Brazing Joints for Copper and  
Copper Alloy Pressure Fittings

MSS SP-78 (2011) Cast Iron Plug Valves, Flanged and  
Threaded Ends

MSS SP-80 (2019) Bronze Gate, Globe, Angle and Check  
Valves

MSS SP-85 (2011) Gray Iron Globe & Angle Valves  
Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99 (2021; TIA 20-1) Health Care Facilities  
Code

UNDERWRITERS LABORATORIES (UL)

UL 778 (2016; Reprint Jun 2021) UL Standard for  
Safety Motor-Operated Water Pumps

UL 1453 (2004) Standard for Electric Booster and  
Commercial Storage Tank Water Heaters

UL 910 (1998) Test for Flame-Propagation and  
Smoke-Density Values for Electrical and  
Optical-Fiber Cables Used in Spaces

Transporting Environmental Air

1.2 SYSTEM DESCRIPTION

Section 22 00 00 PLUMBING, GENERAL PURPOSE shall apply.

1.3 SECTION INCLUDES

- A. Water system to domestic, softened, laboratory use, tempered, and animal feed water distribution systems.
- B. Domestic water system to plumbing fixtures, specialties and equipment; safety shower; eyewash stations and mechanical equipment.
- C. Softened water system to hot water heaters and mechanical equipment.
- D. Laboratory water system to sinks, cupsinks, and laboratory equipment.
- E. Tempered water system to safety showers and eyewashes.
- F. Animal feed purified water system to water pressure stations and equipment.
- G. Sanitary waste/vent system from plumbing fixtures, animal room floor drains, and general use floor drains.
- H. Sanitary waste extending to first manhole on site.
- I. Laboratory waste/vent system from laboratory sinks, cupsinks, laboratory floor drains and laboratory equipment.
- J. Storm water system from roof drains extending to first manhole on site.
- K. Biowaste water system from sinks, drains and laboratory equipment in high containment areas, extending to waste treatment plant.
- L. Clean compressed air system to building management system, laboratory and mechanical equipment, and outlets.
- M. Laboratory vacuum system to laboratory equipment and outlets.
- N. WAGD vacuum system to medical outlets.
- O. Nitrogen gas system to laboratory equipment and outlets.
- P. High purity nitrogen gas system to laboratory equipment and outlets.
- Q. Liquid nitrogen system to laboratory equipment and outlets.
- R. Carbon dioxide gas system to laboratory equipment and outlets.
- S. Brine system to softeners.
- T. Detergent transfer system to day tanks in cage wash area.
- U. Detergent cleaning system to cage washers and tunnel washers.
- V. Piping and final connections to fume hood cold and hot water faucets.

1.4 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Install liquid faucets and gas outlets on laboratory casework. Casework is specified under Section 12 35 53.13 METAL LABORATORY CASEWORK.
- B. Install liquid faucets and gas outlets on fume hoods and biological safety cabinets. Fume hoods and biological safety cabinets are specified under Section(s) 11 53 13 and 11 53 53 BIOLOGICAL SAFETY CABINETS.
- C. Install wall mounted gas outlets specified under Section 22 62 16 LABORATORY GAS AND VACUUM SYSTEM.

1.5 RELATED SECTIONS

- A. Section 01 31 19 PROJECT MEETINGS 01 31 11 SUSPENDED LOADING - COORDINATION AND LIMITATIONS, for coordination and limitations of suspended loading.
- B. Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.
- C. Section 07 92 00 JOINT SEALERS.
- D. Section 11 53 13 FUME HOODS, for furnishing and installation of cupsinks, drains with tailpieces, cold and hot water faucets and gas outlets at fume hoods.
- E. Section 11 53 53 BIOLOGICAL SAFETY CABINETS, for furnishing and installation of gas outlets at biological safety cabinets.
- F. Section 12 35 53.13 METAL LABORATORY CASEWORK, for furnishing and installation of sinks, cupsinks, eyewash units and drains with tailpieces at casework.
- G. Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- H. Section 22 05 29 PLUMBING HANGERS AND SUPPORTS.
- I. Section 22 05 48 PLUMBING SOUND, VIBRATION AND SEISMIC CONTROL.
- J. Section 22 05 53 PLUMBING IDENTIFICATION.
- K. Section 22 05 75 DRAINS AND CLEANOUTS.
- L. Section 22 07 00 PLUMBING INSULATION.
- M. Section 22 10 06 BUILDING SERVICES PROCESS PIPING SCHEDULES, for piping schedules, testing and cleaning.
- N. Section 22 10 19 PIPING SPECIALTIES.
- O. Section 22 11 23 WATER PRESSURE BOOSTER SYSTEM.
- P. Section 22 13 36 PNEUMATIC EJECTORS.
- Q. Section 22 31 00 WATER SOFTENERS.
- R. Section 22 33 00 WATER HEATERS.

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- S. Section 22 42 00 COMMERCIAL PLUMBING FIXTURES.
  - T. Section 22 62 16 LABORATORY GAS EQUIPMENT.
  - U. Section 22 67 00 PURIFIED WATER GENERATING EQUIPMENT.
  - V. Section 22 71 00 AUTOMATIC ANIMAL WATERING SYSTEM.
  - W. Section 22 72 00 DETERGENT TRANSFER SYSTEM.
  - X. Section 22 72 00.01 EFFLUENT DECONTAMINATION SYSTEM.
  - Y. Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
  - Z. Section 26 20 00 INTERIOR DISTRIBUTION.
  - AA. Section 26 28 00.00 10 MOTOR CONTROL CENTERS AND PANELBOARDS, for magnetic motor starters.
  - BB. Section 31 00 00 EARTHWORK, for excavation and backfilling for utility trenches.
  - CC. Section 33 11 00 WATER DISTRIBUTION.
  - DD. Section 33 30 00 SANITARY SEWERS.
  - EE. Section 33 40 01 STORM DRAINAGE, for site storm sewage system and manholes.
  - FF. Section 33 46 00 SUBDRAINAGE SYSTEMS, for perimeter foundation subdrainage systems.
  - GG. Section 40 17 26.00 WELDING PRESSURE PIPING, for pressure, drainage and vent piping welding procedures.
- 1.6 QUALITY ASSURANCE
- Comply with:
- A. ASME BPVC - ANSI/ASME Boiler and Pressure Vessel Code.
  - B. ASHRAE 90.1 - IP - ASHRAE Standards 90.1b.
  - C. HI SCRRP - Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps.
  - D. National Sanitation Foundation.
  - E. Local utility company.
  - F. UL 778 - Standard for Motor Operated Water Pumps.
  - G. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- 1.7 REGULATORY REQUIREMENTS

Comply with:



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- A. ICC IBC - International Building Code.
- B. ICC IPC - International Plumbing Code.
- C. UFC 3-420-01 - United Facilities Criteria - Plumbing System.
- D. State of Maryland Department of Environmental Protection.
- E. NFPA 99 - Health Care Facilities.

### PART 2 PRODUCTS

For description of Piping Systems, see Schedules in Section 22 10 06  
BUILDING SERVICES AND PROCESS PIPING SCHEDULES.

#### 2.1 JOINTS AND GASKET MATERIALS

Joints and gasket materials shall conform to the following:

- A. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310.
- B. Coupling for Steel Pipe: AWWA C606.
- C. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12), Malleable Iron ASTM A47/A47M, Grade 32510. Copper ASTM A536.
- D. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- E. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.
- F. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
- G. Solder Material: Solder metal shall conform to ASTM B32.
- H. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.
- I. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.
- J. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.
- K. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.
- L. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477.
- M. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

- N. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.
- O. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.
- P. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.
- Q. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing element shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

## 2.2 VALVES

Valves shall be provided on supplies to equipment and fixtures. For domestic and laboratory water service applications, Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing; valves 3 inches and larger shall have flanged iron bodies with bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1

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Description	Standard
Vacuum Relief Valves	ANSI Z21.45
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

### 2.3 INCOMING WATER SERVICE AND WATER SYSTEMS

Including domestic use, laboratory use, and tempered water systems.

#### 2.3.1 Below Grade

##### 2.3.1.1 2 Inch and Smaller

Schedule P-5.3

##### 2.3.1.2 3 Inch and Larger

Schedule P-2.1

#### 2.3.2 Above Grade

##### 2.3.2.1 4 Inch and Smaller

Schedule P-5.1 or P-4.8

##### 2.3.2.2 6 Inch and Larger

Schedule P-3.5

### 2.4 SOFTENED WATER SYSTEM

#### 2.4.1 Above Grade

##### 2.4.1.1 3 Inch and Smaller

Schedule P-5.1

##### 2.4.1.2 4 Inch and Larger

Schedule P-5.12

### 2.5 RO PURIFIED WATER

Schedule P-6.3 or P-4.8

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## 2.6 SANITARY WASTE AND STORM WATER SYSTEMS

### 2.6.1 Gravity Piping, Below Grade

Schedule P-1.1

### 2.6.2 Gravity Piping, Above Grade

#### 2.6.2.1 Waste and Vent

Schedule P-1.2

#### 2.6.2.2 Indirect Waste

Schedule P-5.2

### 2.6.3 Wastewater Pump Discharge, Above Grade

#### 2.6.3.1 3 Inch and Larger

Schedule P-3.3

#### 2.6.3.2 2 Inch and Smaller

Schedule P-5.2

## 2.7 BIOWASTE SYSTEM

### 2.7.1 Gravity Piping, Above Grade

All sizes: Schedule P-4.1

### 2.7.2 Gravity Piping, Below Grade

All sizes: Schedule P-7.6

### 2.7.3 Pumped (from locker room area)

All sizes: Schedule P-4.1

## 2.8 LABORATORY WASTE SYSTEM

### 2.8.1 Gravity Piping, Below Grade

All sizes: Schedule P-6.5

### 2.8.2 Gravity Piping, Above Grade

All sizes: Schedule P-6.1

### 2.8.3 Indirect Waste

All sizes: Schedule P-6.1

## 2.9 LABORATORY AND HIGH PRESSURE COMPRESSED AIR SYSTEM(S)

### 2.9.1 4 Inch and Smaller

Schedule P-5.13

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2.10 LABORATORY VACUUM SYSTEM AND EXHAUST PIPING

Schedule P-5.4 or P-4.8

2.11 LABORATORY NITROGEN GAS SYSTEMS

2.11.1 4 Inch and Smaller

Schedule P-5.13

2.12 HIGH PURITY NITROGEN GAS SYSTEM

Schedule P-5.8

2.13 LIQUID NITROGEN SYSTEM

As specified in Section 22 63 17.

2.14 CARBON DIOXIDE GAS SYSTEM

Schedule P-5.5 or P-4.8

2.15 LABORATORY OXYGEN AND LABORATORY NITROUS OXIDE GAS SYSTEMS

Schedule P-5.13 or P-4.8

2.16 MEDICAL OXYGEN GAS SYSTEM

Schedule P-5.9

2.17 WAGD VACUUM, ARGON GAS AND HELIUM GAS SYSTEM

Schedule P-5.8

2.18 BRINE SYSTEM

2.18.1 Above and Below Grade

Schedule P-7.5

2.19 DETERGENT DISPENSING SYSTEM

Schedule P-6.2

2.20 ANIMAL FEED WATER BUILDING DISTRIBUTION SYSTEM

Schedule P-4.4

2.21 DETERGENT TRANSFER SYSTEM

Schedule P-4.6

2.22 BREATHING AIR SYSTEM

Schedule P-5.14 or P-4.8

## 2.23 EMERGENCY ANIMAL WATERING SUPPLY

### Schedule P-6.3

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Quality Control

Install systems in accordance with approved submittals and referenced standards, manufacturer's recommendations, and Section 01 45 10 CONTRACTOR QUALITY CONTROL regarding Quality Control of installation

#### 3.1.2 Exposed Piping

No exposed piping in finished spaces, Laboratory areas and Vivarium areas shall be permitted, unless specifically indicated on drawings. Exposed piping shall be chrome plated brass or stainless steel.

#### 3.1.3 Fume Hoods

Install piping within fume hoods and below countertop. Install full size piping up to outlets. Reduce only as required, and as close as possible to outlets and valves.

#### 3.1.4 Identification

Identify piping in accordance with Section 22 05 53 PLUMBING IDENTIFICATION.

#### 3.1.5 Insulation

Insulate piping in accordance with Section 22 07 00 THERMAL INSULATION FOR PLUMBING SYSTEMS.

#### 3.1.6 Valve Installation Procedures

- A. When two or more valves of the same type are used in the same service, all valves of this type must be from the same manufacturer.
- B. Unless noted otherwise, valves shall open when handwheel or stem is turned in a counter-clockwise rotation and shall close when turned in a clockwise rotation. Valves equipped with gear operators shall function similarly.
- C. Provide valve stem extensions on all valves installed on insulated systems. Provide sufficient clearance to allow operation of the valve without any damage to the full thickness insulation. Extensions shall allow jacketing to be installed continuous without tears or breaks in vapor barrier.
- D. Provide valves at branch connections to mains and at equipment.
- E. Use valves of same size as pipe in which they are installed, except for modulating type control valves furnished under Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Two position type (open/close) control valves by section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC will be furnished in line size.

- F. Install valves with the stem on or above the horizontal. Install globe valves with pressure under seat.
- G. Pack valves and adjust glands before final approval.
- H. Install valve extension stems and chain operators on valves 6 inch and larger where valve stem centerline exceeds 6 feet, 6 inches above finished floor. Provide chain hooks where required, to prevent fouling of chains on equipment and to clear walk-ways. Terminate chains approximately 3 feet, 6 inches above floor.
- I. Install valves so they are accessible for operation, and free from interference when operated.
- J. Install butterfly valve to flanges with disc in open position.
- K. Where butterfly valves are used in dead end service for future connections, install a spool piece downstream of the valve flange equal to two pipe diameters. Terminate with a companion flange and blind flange.
- L. After installation, cut threaded stud on valve bonnets and flanges to expose a minimum of 1-1/2, but not more than 3 threads beyond nut.

### 3.1.7 Pipe Installation Procedures

#### 3.1.7.1 General

- A. Clean piping materials before installation to remove grease, loose dirt, mill scale and other foreign matter.
- B. Group piping whenever practical at common elevations.
- C. Space piping to maintain at least 2 inch clearance from any other object, including movement due to temperature changes. When piping is insulated, maintain 2 inch clearance between insulation and adjacent insulated piping, walls or other objects.
- D. Install piping free of traps and with sufficient slope to allow drainage to one or more points. In event that drainage is not possible due to structural obstructions and finished ceiling heights, provide additional drain valves as required to allow total drainage. Obtain approval on location of drain valves before installation.
- E. Locate piping to maintain access to and clearance around equipment. Locate piping systems to maintain 7-foot clear headroom in areas where piping is exposed to view. Do not obstruct coil pulls, filter removals, access doors or work of other Sections.
- F. Locate piping valve train connections for maximum serviceability. Arrange equipment piping connections so that maintenance may be performed with minimum impact to connected piping system.
- G. Provide accessible flanges and union connections on supply and return connections of equipment, valves and other items which must be disconnected or removed for maintenance. Where unions are furnished as an integral part of equipment, additional unions are not required.

- H. Install piping support system following Section 22 05 29 PLUMBING HANGERS AND SUPPORTS.
- I. Hanging from steel roof decks with rigid board insulation is not approved. Provide supplementary support as specified in Section 05 50 00 METALS: MISCELLANEOUS AND FABRICATIONS.
- J. Hanging from steel roof or floor decks is approved only when there is at least 4 inches of concrete over deck. Hanging from electrified floor deck is not approved under any circumstances.
- K. Where pipe support members are welded to structural building framing exposed to the atmosphere, scrape, brush clean, and apply one coat of zinc rich primer to finished welds.
- L. For underground piping excavate subsoil wide enough to allow installation of piping. Remove any rock on unsuitable bedding material. Follow requirements of Section 31 00 00 EARTHWORK for bedding, backfill and compaction.

#### 3.1.7.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

##### A. Threaded:

1. Ream pipe ends to remove burrs.
2. Use only standard taper threads, AWS B2.1. Make threads full, sharp, clean, and free of fins and burrs.
3. Use Teflon joint sealing tape. Apply to male threads only. Conceal threads on chrome plated pipe.
4. Do not use close or short nipples of a size where length of unthreaded pipe is less than width of a pipe wrench.
5. Thredolets or similar code approved fittings may be used for branch connections.
6. Slip joints are permitted only in sanitary drainage systems on fixture side of traps.
7. Factory machine threaded flanges per ASME B16.5 in pressure rating conforming to piping system.

##### B. Mechanical Couplings:

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify



compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

C. Unions and Flanges:

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

1. Use carbon steel bolts and nuts for cast iron flanges unless otherwise noted. Use alloy steel for steel flanges and High Strength for High Pressure Systems.
2. Except for stainless steel piping, lubricate bolts or studs over entire thread length with graphite and oil mixture.
3. Install piping to equipment without strain. Remove bolts in flanged connections or disconnect piping after installation, to demonstrate bolt hole alignment and fit, if requested.
4. Provide gaskets at flanged connections suitable for design pressure and temperature of fluid contained. Use ring type for raised face flanges, and full face for flat face flanges.

D. Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

E. Cast Iron Soil, Waste and Vent Pipe:

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

F. Copper Tube and Pipe:

1. Braze. Braze joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

2. Soldered. Soldered joints shall be made with Sb5 solder and flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
3. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.
4. Press connection. Copper press connections shall be made in strict accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer of that joint. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.
5. For solder or braze connections, do not use compression type fittings.
6. Make connections following CDA A4015

G. Laboratory Waste Plastic Pipe

Joints for pipe and fittings shall be made by mechanical joint or electrical fusion coil method in accordance with ASTM D2657 and ASTM F 1290. Joints for filament-wound reinforced thermosetting resin pipe shall be made in accordance with manufacturer's instructions. Unions or flanges shall be used where required for disconnection and inspection.

H. Biowaste Double Wall FRP Pipe

Install pipe in accordance with pipe manufacturer's requirements. All components shall be from one manufacturer to ensure system integrity and warrantee. Plan for installation and use of leak detection cable before and during fabrication. All fitters shall be trained and approved by a factory authorized representative prior to the installation of any materials. Prepare pipe ends and fittings by lightly sanding to completely clean. Mix adhesive according to directions on the container and account for the ambient temperature. For piping 4 IN and smaller use a pulling swab with pull and return cords to remove excess adhesive as work progresses. Use of a heat curing tape or blanket may be required based upon manufacturer's requirements or ambient temperatures. Factory or shop prefabricated pipe sections to minimize field joints and ensure system quality. Inner pipe joints shall be done first. Once cured the inner joints shall be inspected and tested. Once successful then outer pipe joints can be fabricated, cured and tested. Pressure test outer pipe with the inner pipe filled with water and pressurized to 5 PSIG. Once complete and successfully tested install leak detection cable.

3.2 INCOMING WATER SERVICE AND WATER SYSTEMS

Including incoming water service, domestic use, , laboratory use tempered, softened and animal feed water water systems.

3.2.1 Water Meter Location

Water meter shall be installed on the main non-biohazard water supply and

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biohazard water supply branch.

### 3.2.2 Water Meter Installation

Install water meter assembly complete with reduced pressure backflow preventer, strainer and other accessories.

### 3.2.3 Protection of Water Distribution Systems

Protect water distribution systems against backflow and siphonage, both natural and induced.

### 3.2.4 Backflow Preventers

Install backflow preventers as specified in Section 22 10 19 PLUMBING, PIPING SPECIALTIES to isolate equipment connected to domestic and/or laboratory water system(s).

### 3.2.5 Additional Backflow Preventers

Install additional backflow preventers in biohazard water supply branches.

### 3.2.6 Balancing

Balance hot water recirculating systems and tempered water system to deliver required flow and temperature to faucets, fixtures and equipment. Refer to Section 23 05 93.00 10 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

### 3.2.7 Retainer Glands

Provide retainer glands when mechanical joint ductile iron pipe is installed at point of building entry for incoming water service.

## 3.3 STORM WATER, SANITARY AND LABORATORY WASTE SYSTEMS

### 3.3.1 Preparation

Prior to installation of underground piping, remove large stones or other hard matter which could damage pipe or prevent consistent backfilling or compaction. Place pipe on compacted subgrade. Follow Section 31 00 00 EARTHWORK.

### 3.3.2 Maximum Variation from True Slope

Lay pipe to maximum variation from true slope of 1/8 inch in 10 feet (1:1000).

### 3.3.3 Vertical Lines

Install vertical lines plumb

### 3.3.4 Horizontal Lines - Minimum Uniform Pitch

Install horizontal lines 4 inches and larger with a minimum uniform pitch of 1/8 inch per foot (1:100) unless shown otherwise. Install piping 3 inches and smaller with a minimum uniform pitch of 1/4 inch per foot (1:50) unless shown otherwise. Make changes in pipe sizes with reducers or increasers.

### 3.3.5 Connections of Horizontal Lines with Vertical Stacks

Connect horizontal lines with vertical stacks using 45 degree "Y" branches, 60 degree "Y" branches, combination "Y" and 1/8 bend branches, and sanitary tees or other acceptable fittings of equivalent sweep. Short sweeps may be used in soil and waste lines where flow direction changes from horizontal to vertical.

### 3.3.6 Connections between Horizontal Lines

Connect horizontal lines with other horizontal lines using 45 degree "Y" branches, combination "Y" and 1/8 bend branches, or other fittings of equivalent sweep.

### 3.3.7 Connections of Vertical Lines with Horizontal Lines

Connect vertical lines with horizontal lines using 45 degree "Y" branches, combination "Y" and 1/8 bend branches, or other fittings of equivalent sweep.

### 3.3.8 Vents

Extend vent pipes through roof. Vents through roof must be a minimum of 4 inch pipe size with the change of size at least 12 inches below the underside of the roof. Do not locate vents within 10 feet of windows or air intakes. Base flashing is specified under roofing specifications. Counterflashing is specified under Division 07. Extend vents at least 12 inches above the roof.

### 3.3.9 Underground Soil Piping

3 inch minimum

### 3.3.10 Underground Waste Water Piping

2 inch minimum

### 3.3.11 Cleanouts

Provide cleanouts at beginning of each run, at each change of direction and at intervals in piping so that maximum spacing between cleanouts is 50 feet for pipe of 4 inch diameter and smaller, and 100 feet for piping over 4 inch diameter.

### 3.3.12 P-Traps

All floor drain traps shall be deep seal P-type with 4 inch water seal.

### 3.3.13 PVDF Plastic Pipe

Use PVDF plastic pipe for traps and horizontal runs below floor for laboratory waste piping from floor drains from cagewash equipment and sterilizers. Run PVDF up to the stack and then transition to polypropylene.

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### 3.4 BIOWASTE SYSTEM

#### 3.4.1 Automatic Trap Priming

No Automatic trap priming shall be provided to all floor drains in ABSL-3E, BSL-3E and BSL-4 areas. Traps will be filled daily with a water and disinfectant solution by the occupants.

#### 3.4.2 Drain Lines

All drains from sinks, sterilizers, fume hoods, and equipment open to the room (except floor drains) shall be tri-clamp fittings to a point immediately after the trap. Install biowaste piping at 2 percent slope for piping less than 3 inch diameter. Install piping 3 inches and larger at 1 percent slope.

#### 3.4.3 P-Traps

All plumbing fixture traps in ABSL-3E and BSL-3 only including laboratory sinks and floor drain traps shall be deep seal type with 7 inch water seal. P-traps in BSL-4 shall be deep seal with a 12 inch water seal.

### 3.5 LABORATORY GAS SYSTEMS

Including laboratory and high pressure compressed air, laboratory vacuum, carbon dioxide, laboratory and high purity nitrogen and laboratory oxygen systems.

#### 3.5.1 General

After installation of each section of piping, and prior to installation of service outlet valves, blow system clear of moisture and foreign matter.

### 3.6 MEDICAL GAS SYSTEMS

Including WAGD vacuum, medical oxygen and breathable air gas systems.

#### 3.6.1 Installation and Inspection Qualifications

Installation of these systems can be done only by currently certified medical gas installers in accordance with NFPA 99 and ANSI/ASSE 6000 Series Professional Qualification Standard for Medical Gas System Installers. These systems shall be inspected by an independent certified medical gas inspector hired by the Contractor who shall carry out all final certification testing in accordance with NFPA 99.

#### 3.6.2 Preparation

Use factory pre-cleaned components. Where that is not possible, before installation, thoroughly wash pipe, fittings, valves and components. Use a hot solution of sodium carbonate or trisodium phosphate, one pound chemical to 3 gallons of water. After washing, rinse with water, dry and cap until installation.

#### 3.6.3 Brazing

Do not use flux on brazed joint systems. During brazing of pipe connections, purge interior of pipe continuously with nitrogen.

#### 3.6.4 Sloping

Slope piping in direction of flow.

#### 3.6.5 Strainers and Valves

Install strainers on inlet side of pressure reducing valves. Provide main gas valves (pressure reducing or flow control) with by-passes and isolation valves to permit maintenance without interruption of gas.

### 3.7 ARGON, HELIUM AND SPECIAL GASES GAS SYSTEMS

#### 3.7.1 Preparation

Use factory pre-cleaned components. Where that is not possible, before installation, thoroughly wash pipe, fittings, valves and components. Use a hot solution of sodium carbonate or trisodium phosphate, one pound chemical to 3 gallons of water. After washing, rinse with water, dry and cap until installation.

#### 3.7.2 Brazing

Do not use flux on brazed joint systems. During brazing of pipe connections, continuously purge interior of pipe with nitrogen.

#### 3.7.3 Sloping

Slope piping in direction of flow.

#### 3.7.4 Strainers and Valves

Install strainers on inlet side of pressure reducing valves. Provide main gas valves (pressure reducing or flow control) with by-passes and isolation valves to permit maintenance without interruption of gas.

### 3.8 TRAP PRIMING

Soft temper copper coil shall be encased in PVC conduit.

### 3.9 DETERGENT TRANSFER SYSTEM

#### 3.9.1 Installation of Drain Valves

Install 1/2 inch drain valves at low points of system.

#### 3.9.2 Protection of Flanges

Protect flanges with flange shields.

### 3.10 DETERGENT CONDUIT

Install conduit system as shown on drawings.

#### 3.10.1 Manufacturer's Recommended Procedures

Install conduit and solvent cemented joints in accordance with manufacturers recommended procedures. Store materials at ambient temperatures between 40 to 100 degrees F.

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### 3.10.2 Quality Requirement

Installed conduit shall be free from dents, bruises and other damage.

### 3.10.3 Plug Conduit Ends

Plug conduit ends to prevent entry of dirt and moisture.

### 3.10.4 Headroom and Space Interference

Install conduit to conserve headroom and cause minimum interference in spaces through which conduit passes.

### 3.10.5 Exposed Conduit and Extensions

Install exposed conduit and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and structural members.

### 3.10.6 Pull Boxes

Provide pull boxes at approximately 100 foot intervals and at alternate floor levels where passing through multiple floors. Install pull boxes to provide access for pulling detergent tubing.

### 3.10.7 Identification

Clearly label conduit runs and pull boxes as to service and final location of run. Pre-paint prior to fabrication a continuous 2 inch wide yellow stripe on opposite sides along the length of the conduit to differentiate from electrical power conduit.

### 3.10.8 Detergent Tubing

Upon successful testing of conduit, run detergent tubing through conduit. Clearly label each tubing run along its length to allow clear identification at each pullbox.

### 3.10.9 At Washing Equipment

At washing equipment, transition to 316 stainless steel tubing with double ferrule mechanical compression joints dropping down from ceiling to equipment. Provide flow indicating sight glass, isolation valve and low point drain valve.

## 3.11 LIQUID NITROGEN

### 3.11.1 Manufacturer's Requirements

Install piping in accordance with manufacturer's requirements.

### 3.11.2 Insulation of Field Joints

Insulate field joints with pre-formed half sections of urethane foam or liquid urethane foam kits.

### 3.11.3 Sleeves for Field Joints

Use tubular or wraparound sleeves for field joints.

#### 3.11.4 Field Fabricated Joints

Minimize field fabricated joints.

#### 3.11.5 Safety Relief Valves

Provide safety relief valves between shut-off valves and in any other part of the system where liquid can be contained and vaporize into a gas due to heat loss.

#### 3.11.6 Piping System Contraction

Allow for piping system contraction by use of expansion/contraction loops or internal bellows fittings.

### 3.12 PURIFIED (RO) WATER SYSTEM

#### A. Examination:

1. Verify components prior to installation to ensure that factory cleaning and bagging meets specified requirements.
2. Verify wall thickness on tubing and fittings prior to installation. Material with wall thickness varying by more than plus .005 inches from specified thickness, will be rejected.

#### B. Piping System:

1. Clean pipe interior and open pipe ends before installation. Remove grease, loose dirt and other foreign matter with isopropyl alcohol.
2. Handle material in such manner as to prevent introduction of contaminant into the piping system.
3. Install tubing to permit free expansion and contraction, without damage to joints or supports.
4. Provide supports for vertical risers minimum 3 feet on center and at every floor.
5. Provide supports at each change of direction.
6. Make joints between pipe and other materials with polypropylene adaptors suitable for the specific application.
7. Identify piping by tagging at end of each working day.
8. Identify pipe at minimum 15 foot intervals with stenciling or applied decals in accordance with Section 22 05 53 PLUMBING IDENTIFICATION.
9. No more than 3 percent of total welds may be non IR fusion welds.
10. Install plenum wrap on piping in accordance with manufacturer's requirements and UL 910 listing.

#### C. System components shall be installed using the IR (Infrared) Butt Fusion or Standard Butt Fusion joining method according to current



installation instructions as delivered in print or documented by manufacturer. An on site installation seminar shall be conducted by manufacturer's personnel who are certified to conduct said seminar. Seminar topics shall include all aspects of product installation (storage, set up, support spacing, fusion process, machine care, testing procedure, etc.). At the conclusion of the seminar, all installers will be given a written certification test and will be required to prepare and complete one fusion joint of the type being implemented on the project. Upon successful completion of said test, the installer will be issued a certification card verifying that they have met the requirements of the manufacturer with regard to knowledge of proper product installation and testing methods.

- D. Only the manufacturer recommended piping system fusion units may be used to install the piping system.

Under this specification, the Contractor shall be responsible for the purchase or rental of the proper machine required to meet the intent of the specification and be used for installation of the product on site.

- E. Installer shall ensure that all pipe and fittings used for Pure Water Piping are components of the same system. No mixing of various manufacturers' pipe and/or fittings shall be permitted.

### 3.13 BIOWASTE PIPING WELDING

Refer to section 40 17 26.00 WELDING PRESSURE PIPING for welding, examination and testing criteria.

-- End of Section --

WELD SCHEDULE SHEET  
(FIGURE 1)

CUSTOMER: \_\_\_\_\_ WELD SCHEDULE NO. \_\_\_\_\_

DATE PREPARED: \_\_\_\_\_

E. ALLOY \_\_\_\_\_ TYPE OF JOINT \_\_\_\_\_

TUBE O.D. \_\_\_\_\_ WALL THICKNESS \_\_\_\_\_

WELDING HEAD MODEL \_\_\_\_\_ ELECTRODE DIA. \_\_\_\_\_ LENGTH \_\_\_\_\_ GAP \_\_\_\_\_

POWER SOURCE MODEL \_\_\_\_\_ ELECTRODE TIP \_\_\_\_\_

WELD LEVEL I    WELD LEVEL II    WELD LEVEL III    WELD LEVEL IV    PULSE LOW

\_\_\_\_\_ 1                  \_\_\_\_\_ 2                  \_\_\_\_\_ 3                  \_\_\_\_\_ 4                  \_\_\_\_\_ 5

LEVEL I TIME    LEVEL II TIME    LEVEL III TIME    LEVEL IV TIME    HEAD SPEED  
R.P.M.

\_\_\_\_\_ 6                  \_\_\_\_\_ 7                  \_\_\_\_\_ 8                  \_\_\_\_\_ 9                  \_\_\_\_\_ 10

FINISH SLOT    PULSE HIGH TIME    PULSE LOW TIME    ROTATION  
DELAY TIME

\_\_\_\_\_ 11                  \_\_\_\_\_ 12                  \_\_\_\_\_ 13                  \_\_\_\_\_ 14

PULSE \_\_\_\_\_

STEP PULSE \_\_\_\_\_

OFF \_\_\_\_\_

Arc Start  
Position \_\_\_\_\_

Arc Gas CF11 \_\_\_\_\_

Arc Gas CF11 \_\_\_\_\_

Pre and Post  
Purge \_\_\_\_\_

	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

WELD INSPECTION CHECK SHEET  
(FIGURE 2)

CUSTOMER \_\_\_\_\_ PROJECT \_\_\_\_\_

1. WELD: # \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_

2. SERVICE: DW \_\_\_\_\_ DI \_\_\_\_\_ P \_\_\_\_\_ D \_\_\_\_\_ CIP \_\_\_\_\_ OTHER \_\_\_\_\_

3. WELDERS'S NAME \_\_\_\_\_

4. MACHINE ID: # \_\_\_\_\_ MACHINE TYPE \_\_\_\_\_

5. LOCATION: SITE SHOP \_\_\_\_\_ IN PLACE \_\_\_\_\_ BLDG.# \_\_\_\_\_

6. SIZE: 1/2" \_\_\_\_\_ 1 1/2" \_\_\_\_\_ 2" \_\_\_\_\_ OTHER \_\_\_\_\_

7. COMPONENTS:

TUBE _____	TUBE _____
ELBOW _____	ELBOW _____
TEE _____	TEE _____
REDUCER _____	REDUCER _____
FERRULE _____	FERRULE _____

8. PREP: TUBE & MACHINED \_\_\_\_\_ DEBURRED \_\_\_\_\_ ALL COMPONENT \_\_\_\_\_

9. MACHINE: WARM UP OK \_\_\_\_\_ DUMMY WELD \_\_\_\_\_ PRODUCTION WELD \_\_\_\_\_

10. WELD:

A. TACK:	YES _____	NO _____
B. ALIGNMENT ELECTRODE:	YES _____	NO _____
C. PURGE BLADDER IN PLACE:	YES _____	NO _____

11. WELDING PROGRAM NUMBER \_\_\_\_\_ COMMENTS ON REVERSE \_\_\_\_\_

12. REFERENCE: DRAWING # \_\_\_\_\_ ISO # \_\_\_\_\_

13. WELD POSITION: 2G \_\_\_\_\_ 5G \_\_\_\_\_

14. INSPECTION

STRIP CHART: MASTER MATCH _____	NON-MATCH _____	NONE _____
ID VISUAL: BOROSCOPE _____	MIRROR _____	
ACCEPTED _____	REJECTED _____	
CD VISUAL ACCEPTED _____	REJECTED _____	
PIPE MAKER: WELDER SYMBOL _____	WELD NO. _____	

REJECTED FOR:

INCOMPLETE PENETRATION _____	CRACK _____	TRACK BURN THRU _____
POROSITY PINHOLE _____	COLD LAP _____	INCOMPLETE FUSION _____
MISALIGNMENT _____	SUGARING _____	NOT INSPECTED _____
OTHER _____		RADIOGRAPHY REQUIRED _____

15. TESTING RADIOGRAPH

BY: OWNER _____	PIPING INSTALLER _____	DYE PENETRANT _____	NONE _____
REASON: RANDOM DUMMY _____	RANDOM PRODUCTION _____	INDEPENDENT _____	SETTING _____
			CHARGE _____

RESULTS: ACCEPTED \_\_\_\_\_ REJECTED \_\_\_\_\_

OWNER APPROVAL  
DATE: \_\_\_\_\_

WELDING SUPERVISOR  
DATE: \_\_\_\_\_

OTHER SUPERVISOR  
DATE: \_\_\_\_\_

SECTION 22 10 06

BUILDING SERVICES AND PROCESS PIPING SCHEDULES  
09/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084 (2017) Standard Methods for the Examination of Water and Wastewater

AWWA C104/A21.4 (2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C110/A21.10 (2012) Ductile-Iron and Gray-Iron Fittings for Water

AWWA C111/A21.11 (2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C151/A21.51 (2017) Ductile-Iron Pipe, Centrifugally Cast

AWWA C606 (2015) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2019) Specification for Filler Metals for Brazing and Braze Welding

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1 (2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASME B16.18 (2021) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.21 (2021) Nonmetallic Flat Gaskets for Pipe Flanges

Repair Steam Sterilization Plant (SSP)

ASME B16.22	(2018) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B31.1	(2020) Power Piping
ASME B31.3	(2020) Process Piping
ASME B36.19M	(2004; R 2015) Stainless Steel Pipe
ASTM INTERNATIONAL (ASTM)	
ASTM A126	(2004; R 2019) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A182/A182M	(2021) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A269/A269M	(2015; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A270/A270M	(2015; R 2019) Standard Specification for Seamless and Welded Austenitic and Ferritic/Austenitic Stainless Steel Sanitary Tubing
ASTM A312/A312M	(2021) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351/A351M	(2018) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
ASTM A380/A380M	(2017) Standard Practice for Cleaning,

Repair Steam Sterilization Plant (SSP)

	Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A403/A403M	(2020) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A632	(2004; R 2014) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
ASTM A74	(2021) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A789/A789M	(2020) Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service
ASTM A888	(2021a) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B306	(2020) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B366/B366M	(2020) Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings
ASTM B819	(2000; R 2011) Standard Specification for Seamless Copper Tube for Medical Gas Systems
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM C564	(2020a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

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ASTM D2122	(2016) Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2310	(2006; R 2012) Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D2837	(2022) Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
ASTM D2846/D2846M	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2996	(2017) Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3222	(2018a) Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
ASTM D4101	(2017) Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM F441/F441M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM G93/G93M	(2019) Standard Guide for Cleanliness Levels and Cleaning Methods for Materials and Equipment Used in Oxygen-Enriched Environments

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2018) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2012) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-10.1	(2008) Commodity Specification for
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## Repair Steam Sterilization Plant (SSP)

Nitrogen; 7th Edition

CGA G-4.1 (2009) Cleaning Equipment for Oxygen Service; 6th Edition

CSA AMERICA, INC. (CSA/AM)

CSA C22.2 No. 211.2 (2021) Rigid PVC (Unplasticized) Conduit

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MSS SP-43 (2019) Wrought Stainless Steel Butt-Welding Fittings

MSS SP-80 (2019) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 55 (2020; TIA 21-1) Compressed Gases and Cryogenic Fluids Codes

NFPA 99 (2021; TIA 20-1) Health Care Facilities Code

NSF INTERNATIONAL (NSF)

NSF 61 (2016) Drinking Water System Components - Health Effects

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 50.12 National Primary and Secondary Ambient Air Quality Standards for Lead

UNDERWRITERS LABORATORIES (UL)

UL 723 (2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

UL 94 (2013; Reprint Mar 2022) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

### 1.2 SECTION INCLUDES

- A. Piping system components, materials and limitations.
- B. Testing and cleaning.



### 1.3 RELATED SECTIONS

- A. Section 22 10 05 - BUILDING SERVICES AND PROCESS PIPING SYSTEMS, for application of piping schedules to various systems.
- B. Section 22 00 00 - PLUMBING, GENERAL PURPOSE.
- C. Section 40 17 26.00 - WELDING PRESSURE PIPING, for pressure, drainage and vent piping welding procedures.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Piping system components; G, AE

Submit schedule identifying each product; sizes, materials, and capacities.

#### SD-06 Test Reports

Field test reports

#### SD-07 Certificates

Field tests

Certify that specified field tests have been performed and that work meets or exceeds specified requirements.

Disinfecting

Certify that systems have been disinfected as specified.

#### SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions

#### SD-10 Operation and Maintenance Data

Piping system components; G, AR

Include assembly views, lubrication instructions, and replacement parts list.

### 1.5 DELIVERY, STORAGE AND HANDLING

Follow Section 01 60 00 PRODUCT REQUIREMENTS.

#### 1.5.1 Valves Storage

Store valves in shipping containers with labeling in place.

## Repair Steam Sterilization Plant (SSP)

### 1.5.2 Flange Faces Protection

Protect flange faces from damage with wood, plastic or soft metal.

### 1.5.3 Pipe Threads Protection

Protect pipe threads from damage with plastic caps.

## 1.6 MAINTENANCE MATERIALS

Follow Section 01 75 00 STARTING AND ADJUSTING.

## PART 2 PRODUCTS

### 2.1 PIPE SYSTEMS MATERIALS

Follow piping schedules at end of this Section.

## PART 3 EXECUTION

### 3.1 PIPING INSTALLATION AND CONNECTIONS

Follow Section 22 00 00 PLUMBING, GENERAL PURPOSE and 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS.

Follow Section 40 17 26.00 WELDING PRESSURE PIPING for welding requirements.

### 3.2 FIELD TESTING

Follow Section 22 00 00 PLUMBING, GENERAL PURPOSE and 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS.

#### 3.2.1 Notification

Alert Contracting Officer, CM and all trades as to the areas and systems being tested to ensure safety in the event of a possible failure.

#### 3.2.2 Schedule of Testing

Test systems before covering or concealment.

#### 3.2.3 Preparation

Flush piping systems before testing.

#### 3.2.4 Leakage During Testing

Should leaks occur during testing, stop test, repair leaks, and repeat entire test from beginning.

#### 3.2.5 Remediation

Repair damage caused by leaks, flooding, or draining.

#### 3.2.6 Separate Testing

Separately test above and below grade drainage systems.

## Repair Steam Sterilization Plant (SSP)

### 3.2.7 For High Rise or Large Systems

For high rise or large systems, they may be tested in sections provided additional valves and fittings are provided to isolate and test the sections.

### 3.2.8 Testing Procedures

Unless otherwise required by local authorities having jurisdiction, follow testing procedures scheduled.

### 3.3 TABLE OF CONTENTS FOR PIPING SCHEDULES

SCHEDULE	SERVICE
P-1.1	Sanitary Waste below grade Storm Water below grade
P-1.2	Sanitary Waste above grade Storm Water above grade
P-2.1	Incoming Water Service below grade 3 inches and larger
P-3.3	Wastewater Pump Discharge above grade
P-3.5	Domestic use water above grade 6 inch and larger. Laboratory use water above grade 6 inch and larger. Softened water above grade 6 inch and larger.
P-4.1	Biowaste/Vent Systems (within high containment area and vents up to vent HEPA filters) Biowaste (outside high containment area to EDS System) Biovent (outside high containment area to roof) Pumped Biowaste (from locker room area)
P-4.2	High Purity Nitrogen Gas High Purity Oxygen Gas
P-4.4	Animal Feed Purified Water (Building Distribution System)
P-4.6	Detergent Transfer System
P-4.8	BSL-4 Piping
P-5.1	Domestic Use Water above grade 3 inches and smaller Laboratory Use Water above grade 3 inches and smaller Softened Water above grade 3 inches and smaller Tempered Water
P-5.2	Indirect Waste
P-5.3	Water Trap Priming
P-5.4	Laboratory Vacuum Laboratory Vacuum Exhaust
P-5.5	Carbon Dioxide Gas
P-5.8	Argon Gas

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SCHEDULE	SERVICE Helium Gas WAGD Vacuum
P-5.9	Medical Oxygen Gas
P-5.12	Domestic Use Water above grade 4 inches and larger Laboratory Use Water above grade 4 inches and larger Softened Water above grade 4 inches and larger
P-5.13	Laboratory Compressed Air 4 inches and smaller High Pressure Compressed Air 4 inches and smaller Laboratory Nitrogen Gas 4 inches and smaller High Pressure Nitrogen Gas 4 inches and smaller
P-5.14	Breathing Air
P-5.15	Solar Water Heating System
P-6.1	Laboratory Waste above grade Laboratory Indirect Waste
P-6.2	Detergent Dispensing System
P-6.3	RO Purified Water Emergency Animal Water Supply
P-6.4	APR Door Pneumatic Piping
P-6.5	Laboratory Waste
P-7.5	Brine
P-7.6	Biowaste/Vent (Below Grade)
P-8.1	Testing and Cleaning
P-8.2	Disinfecting
P-8.3	Testing and Cleaning
P-8.4	Testing and Cleaning
P-8.5	Testing and Cleaning
P-8.6	Testing and Cleaning
P-8.10	Testing and Cleaning
P-8.14	Testing and Cleaning
P-8.15	Testing and Cleaning
P-8.16	Testing and Cleaning
P-8.17	Testing and Cleaning
P-8.18	Testing and Cleaning

SCHEDULE      SERVICE

DRAFT

SCHEDULE P-1.1

A. Service:

1. Sanitary waste below grade.
2. Storm water below grade.

B. Maximum Design:

1. Pressure: Atmosphere.
2. Temperature: 140 degrees F (60 degrees C).

C. Pipe: 3 to 15 inches, bell and spigot, extra heavy cast iron soil pipe (XH); ASTM A74.

D. Joints: Neoprene rubber compression-type gaskets; ASTM C564.

E. Fittings: Extra heavy, bell and spigot, cast iron; ASTM A74.

F. Test and Clean: Follow Schedule P-8.3.

SCHEDULE P-1.2

A. Service:

1. Sanitary waste and vent above grade.
2. Storm water above grade.
3. BV-3 vent downstream of primary HEPA filters.
4. BV-4 vents downstream of HEPA filters.

B. Maximum Design:

1. Pressure: Atmosphere.
2. Temperature: 140 degrees F.

C. Pipe: 1-1/2 to 15 inches; hubless, cast iron soil pipe; CISPI 301 and ASTM A888.

D. Joints: No hub, stainless steel coupling assembly; CISPI 310 with neoprene rubber gasket ASTM C564.

E. Fittings: Hubless, cast iron; CISPI 301 and ASTM A888.

F. Test and Clean: Follow Schedule P-8.4.

SCHEDULE P-2.1

- A. Service: Incoming water service below grade, 3 inch and larger.
- B. Maximum Design:
  - 1. Pressure: 100 psig.
  - 2. Temperature: 200 degrees F.
- C. Pipe: Ductile iron pressure pipe; Class 52, bituminous coated outside; AWWA C151/A21.51. All components of system for water service shall conform to NSF 61.
- D. Lining: Cement-mortar; AWWA C104/A21.4, NSF 61.
- E. Joints: Mechanical, or push-on type; AWWA C111/A21.11.
- F. Fittings: Mechanical joint, ductile iron, bituminous coated outside; AWWA C110/A21.10. Cement lined; AWWA C104/A21.4.
- G. Gaskets: Molded rubber compression type for push on joint, AWWA C111/A21.11 and/or full face for flanged joints, 1/8 inch thick rubber, gasket ID must match pipe ID.
- H. Bolting: Tee-head bolts and hex nuts, material and threading, AWWA C111/A21.11.
- I. Lubricant, If Required: AWWA C111/A21.11.
- J. Mechanical Joint Installation: AWWA C111/A21.11.
- K. Disinfect Incoming Water Service: Follow Schedule P 8.2.



SCHEDULE P-3.3

- A. Service: Wastewater pump discharge above grade.
- B. Maximum Design:
  - 1. Pressure: 100 psig.
  - 2. Temperature: 200 degrees F.
- C. Pipe: Schedule 40 ERW or seamless steel, galvanized; ASTM A53/A53M; Grade B.
- D. Joints: Flanged or rolled grooved.
- E. Joint Coupling: Malleable or ductile iron, Victaulic type zero-flex rigid coupling, galvanized with grade E, type A flush seal gasket; ASTM A47/A47M and ASTM A536.
- F. Fittings: Standard weight galvanized steel, grooved mechanical joint, flanged at valve and equipment connections, long radius elbows.
- G. Flanges: Class 125, flat face, cast iron, galvanized; ASTM A126 and ASME B16.1.
- H. Flange Gaskets: Molded rubber ANSI Full face, 1/8 inch thick rubber, gasket ID must match pipe ID.
- I. Gate Valves:
  - 1. 2 Inch and Larger: Class 125, cast iron, bronze mounted, non-rising stem, flat face, flanged ends.
- J. Check Valves: 3-inch through 12-inch: 175 psi, cast iron body, ductile iron cap, bronze or ductile iron disc. ductile iron hinge, stainless steel shaft, nitrile seat, zinc plated steel hardware, lever and spring, grooved ends, AWWA C606.
- L. Test and Clean: Follow Schedule P-8.1.

SCHEDULE P-3.5

A. Service:

1. Domestic use water above grade 6 inch and larger.
2. Laboratory use water above grade 6 inch and larger.
3. Softened water above grade 6 inch and larger.

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Pipe: Schedule 40 ERW, or seamless, galvanized; ASTM A53/A53M, Grade B. All components of system shall conform to NSF 61.

D. Joints: Rolled grooved.

E. Fittings: Malleable or ductile iron, galvanized, long radius, grooved mechanical joint; ASTM A47/A47M or ASTM A536.

F. Couplings: Malleable or ductile iron, Victaulic type zero-flex rigid coupling, galvanized with grade E gaskets; ASTM A47/A47M or ASTM A536.

G. Flanges: Class 125, Malleable iron, galvanized; ASTM A47/A47M. Victaulic style 741.

H. Flange Gaskets: Molded rubber ANSI Full face, 1/8 inch thick rubber, gasket ID must match pipe ID.

I. Gate Valves: Class 125, 200 psi, cast iron, non-rising stem, full port, flanged ends.

J. Check Valves: Class 125, 200 psi, bronze, swing check, renewable bronze disc and plugs, flanged ends.

K. Butterfly Valves: 200 psi ductile iron body lug style, aluminum bronze disc, EPDM seat, multi-position locking handle, gear operated above 6 inch size. Provide with chain-wheel where specified.

L. Test and Clean: Follow Schedule P-8.1.

M. Disinfect: Follow Schedule P-8.2.

SCHEDULE P-4.1

- A. Service: All drainage (BW, BW-3, BW-4) and vent (BV, BV-3, BV-4) piping within the High Containment (BSL-3 and BSL-4) Lab Block (up to and including floor drain traps). All BSL-3 and BSL-4 vent lines (both inside BSL-3 and BSL-4 and in BV-3 and BV-4 vent lines located below the BSL-3 and BSL-4 Labs and up to primary HEPA filters). Biowaste downstream of floor drain trap vent connections outside high containment area to SSP EDS system and associated vents outside high containment area to HEPA vent assemblies and to roof. Pumped biowaste from locker room area.
- B. Maximum Design:
1. Pressure: 100 psig.
  2. Temperature: 140 degrees F, except 285 degrees F at EDS treatment system area.
- C. Pipe:
1. For drains, vents and EDS system piping, duplex stainless alloy SAF 2205+ or approved equal, Schedule 40S, seamless pipe; beveled ends, conform to UNS S32205, ASTM A789/A789M.
  2. For Biowaste downstream of floor drain trap vent connections outside high containment area to SSP EDS system and associated vents outside high containment area to HEPA vent assemblies and to roof; type 316L alloy stainless steel, schedule 40S, seamless pipe, conform to ASTM A312/A312M.
- D. Joints:
1. Joints shall be welded, except as noted below.
  2. Where attached to plumbing fixtures within BSL-3 and BSL-4 labs use sanitary type clamp fittings as indicated on drawings and shown in details
  3. Where joined to black steel pipe use silver brazed couplings of 904L material
- E. Fittings:
1. For duplex stainless alloy piping only, welded, 904L duplex stainless alloy SAF 2205+ or approved equal, Schedule 40S, commercial grade; ASTM B366/B366M, ASME B16.3 and ASME B16.9.
  2. For 316L piping only, welded, 316L alloy, Schedule 40S; ASTM A403/A403M, ASME B16.3 and ASME B16.9.
- F. Sanitary Clamp Weld Ferrule: 1-1/2 inch, IPS Schedule 5, 316L stainless steel.
- G. Sanitary Clamp: Stainless steel, type 316L, polished two-piece heavy duty with stainless steel bolts.
- H. Gaskets: PVDF, gasket must match fitting and clamps.

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- I. Valves: 1/2 IN to 3 IN; Ball type, 600 psi WOG, 316 stainless steel 3 piece body and ball, full port, butt weld stub ends, Teflon seats and seals with cavity filler, lockable lever handle. Valves for decon ports to have sanitary clamp end with gasket, cap and clamp on end open to atmosphere.
- J. Test and Clean: Follow Schedule P-8.17.

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SCHEDULE P-4.2

A. Service:

1. High purity nitrogen gas.
2. High purity oxygen gas.

B. Maximum Design:

1. Pressure: 300 psig.
2. Temperature: 150 degrees F.

C. Tubing:

1. 316L stainless steel, tube, seamless or welded, Brinnell hardness of 80 RB or less for bending, electropolished interior, 20Ra, mill finish exterior, cleaned for oxygen service, capped and bagged, ASTM A269/A269M or ASTM A270/A270M or ASTM A632, ASTM G93/G93M and CGA G-4.1.

2. Size and Wall Thickness:

1/4 Inch	0.028 Inch
3/8 Inch	0.049 Inch
1/2 Inch	0.065 Inch
3/4 Inch	0.083 Inch
1 Inch	0.095 Inch

D. Joints: Butt welded using orbital weld and nitrogen purge gas.

E. Fittings: Use tube bends as much as possible to avoid the use of fittings. Where required use tube fittings with double ferrule compression joint ends, 316 stainless steel, cleaned for oxygen service. Double ferrule mechanical compression coupling tube fittings or approved equal. Where required use high purity automatic tube butt weld fittings, 316 stainless steel, cleaned for oxygen service. Fittings are to be factory cleaned, capped and bagged. No compression fittings are to be used in concealed spaces. For transition between copper and stainless steel tubing use a mechanical compression reducing union coupling.

F. Ball Valves:

1. 1/2 inch: 2500 pound, ball type, 316 stainless steel body and ball, full port, double ferrule mechanical compression coupling fitting, PTFE seat, PTFE & graphite seals, grade 8 bolts, tie rods and nuts, handle with locking device, pre-cleaned and capped, rated for oxygen service.
2. 3/4 inch and 1 inch: 2500 pound, ball type, 316 stainless steel body and ball, full port, double ferrule mechanical compression coupling fitting ends, PTFE seat, PTFE & graphite seals, grade 8 bolts, tie rods and nuts, handle with locking device, pre-cleaned and capped, rated for oxygen service.
3. Outlet Valves: Laboratory ball valves with removable serrated hose end, forged polished brass with clear epoxy coated chrome plating, lever handle with light green index marked "OXY".

G. Diaphragm Valves:

1. 1/4 inch: 3500 psi rated, diaphragm type, 316L stainless steel globe pattern body, 316 stainless steel diaphragms, trim and double ferrule mechanical compression coupling fitting ends, Teflon wiper ring, pre-cleaned and capped, rated for oxygen service.
2. 1/2 inch through 1 inch: 300 psi rated, diaphragm type, CF3M stainless steel globe pattern body, 316 stainless steel diaphragms, trim and tube ends, Teflon compression ring, pre-cleaned and capped, rated for oxygen service.

H. Exposed Supports within Laboratories: Virgin polypropylene block type supports with 304 stainless steel hardware consisting of bolts, cover plate, weld plate, elongated weld plate, mounting rail, rail and strut nuts.

I. Test and Clean: Follow Schedule P-8.10.

SCHEDULE P-4.4

A. Service: Animal feed purified water (Building distribution system).

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Tubing:

1. 316 (low carbon) stainless steel seamed sanitary type tubing with square ends for automatic welding, 180 grit interior and standard mill finish exterior; ASTM A270/A270M.
2. Acceptable tolerance in O.D. for tubing for ASTM A270/A270M after polishing.

SIZE	OVER	UNDER
1/2 inch	.010	.005
3/4 inch	.010	.005
1 inch	.010	.005

3. Wall Thickness: plus 0.065 inch.
4. Ovality: Plus or minus 0.010 inch.
5. Plane Angularity: Plus or minus 0.005 degrees.
6. Angle Angularity, Fittings: Plus or minus 0.005 degrees.
7. Squareness: Face to tangent, plus or minus 0.005 inch.

D. Mill test reports are required for all material.

1. Each welded valve, tubing and fitting shall be stamped with mill heat number, or a tag number traceable to mill heats of each tube used in fabricating the fitting, accompanied by a letter of compliance from vendor.
2. For machine welding, verify that minimum sulfur content of piping material is at least 0.005 percent.

E. Fittings: Tube O.D. butt weld long tangent AWF, 316L stainless steel, made from ASTM A270/A270M tubing, same wall thickness as straight tubing. Mill heat number of material verification on each fitting. Minimum 0.005 percent sulfur. Finishes as specified for tubing.

F. Ferrules: Material, wall thickness, and finishes as specified for tubing.

G. Joints: Automatic machine orbital butt welded, threaded at ball valves only.

H. Diaphragm Valves: Weir, 316 stainless steel cast body, sanitary ends suitable for clamp type ends, 180 grit interior finish standard mill exterior finish, self-draining, travel stop, (polyarylsylphone PAS

bonnet and handwheel) with sanitary integrals (stainless steel finger plate, spindle and roll pin; bronze bushings and compressor), seal type bonnet fluorlastic TFE two-piece R2 Teflon diaphragm with FDA grade ethylene, propylene elastomer backing cushion and tube nut assembly, clear polysulfone cap over steam.

- I. Ball Valves: 1/2 inch through 4 inch; sanitary type, 1200 psi rated, three piece, 316 stainless steel body, stainless steel ball and stem, full port, Teflon seat, cavity filler and seals, quarter turn, sanitary clamp ends.
- J. Test and Clean: Follow Schedule P-8.16.



SCHEDULE P-4.6

- A. Service: Detergent Transfer System.
- B. Maximum Design:
  - 1. Pressure: 160 psig.
  - 2. Temperature: 400 degrees F.
- C. Piping
  - 1. Size 1/2 inch: 316L Stainless steel, seamless or welded, Schedule 40S plain ends, annealed and pickled, ASTM A312/A312M/ASME B36.19M.
  - 2. Size 3/4 inch to 4 inch: 316L Stainless steel, seamless or welded, Schedule 10S plain ends, annealed and pickled, ASTM A312/A312M/ASME B36.19M.
- D. Fittings:
  - 1. Size 1/2 inch: 3,000lb, gr.F316L stainless steel, SW ends, ASTM A312/A312M/ASME B36.19M.
  - 2. Size 3/4 inch and larger: 316L stainless steel, BW, MSS SP-43 or SS-BW fittings, Gr WP316L SS, Schedule to match Pipe, ASTM A403/A403M/ASME B16.9.
- E. Unions: Size 1/2 inch: 2,000lb 316L Forged SS, with Single Spiral Wound SS gasket, 6 Graphite Filler, 304 SS Retainer, SW Ends.
- F. Nipples: Size 1/2 inch: 316L SS, SMLS, Schedule 80S, annealed and pickled, ASTM A312/A312M/ASME B36.19M, threaded connections shall be avoided.
- G. Bolts: Size 1/2 inch and larger: Gr B7-Stud Bolts, each w/A194 GR 2H heavy hex nuts, ASTM A193/A193M. In clean areas use 304SS stud bolts or hex cap screw, ASTM A193/A193M Gr B8, Cl 2 w/heavy hex 304 SS nuts.
- H. Gaskets: Cl 150 1/16 inch thick, PTFE, ASME B16.21.
- I. Flanges:
  - 1. Size 1/2 inch: Cl 150, RF-SW Flg, Gr F316L SS, ASTM A182/A182M/ASME B16.5, only if required for instrument or equipment connection.
  - 2. Size 3/4 inch and larger: SS LJ-Flg, ASTM A182/A182M Gr F304.
- J. Flange Shields: Transparent polyethylene with snap button fasteners.
- K. Valves:
  - 1. Size 1/2 inch:
    - a. Ball valve: 1,000 psi, 316L SS, SW ends, filled TFE seats and seals, 3-piece body, 316SS external bolting, full port, ASME B16.34.

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b. Check valve: CL200, 316L SS, SW ends, swing type, Y-pattern, 316 SS disc and cap, ASTM A351/A351M/ASME B16.34.

### 2. Size 3/4 inch and larger:

a. Ball valve: CL150, 316 SS body, RF-Flgd, 3-piece body, full port, filled TFE seats and seals, lever operator, handle locking attachment, ASTM A351/A351M/ASME B16.34.

b. Check valve: CL150, 316L SS, RF-Flgd, swing type, Y-pattern, 316 SS disc and cap, ASTM A351/A351M/ASME B16.34.

L. Solenoid Valves: Stainless steel body, pilot operated, Teflon seals, discs, piston and diaphragm, UL listed, RF flanged ends, solenoid, 24 Vdc.

M. Test and Clean: Follow Schedule P-8.14.

SCHEDULE P-4.8

- A. Service: BSL-4 Piping Exposed in Rooms.
1. RO-4 water lines
  2. LHW-4 & LCW-4 water lines
  3. CW-4 and HW-4 water lines.
  4. AW-4 water lines
  5. CS (chemical disinfectant)
  6. BA (breathing air)
  7. CO2 gas
  8. O2 gas
- B. Pipe: Type 316L stainless steel tubing; ASTM A270/A270M. Tubing for gases shall be factory oxygen cleaned, capped and bagged.
- C. Joints: All joints to be welded. Where required for maintenance purposes 316L stainless steel two ferrule mechanical compression fitting connectors are acceptable.
- D. Fittings: Type 316L stainless steel butt weld or two ferrule mechanical compression fitting ends.
- E. Valves: Ball type, 600 psi WOG, 316 stainless steel 3 piece body and ball, full port, butt weld stub ends or two ferrule mechanical compression fitting ends, Teflon seats and seals with cavity filler. Valves for gases shall be factory oxygen cleaned, capped and bagged.
- F. Testing, Cleaning and Disinfecting:
1. For RO-4 water service, follow Schedule P-8.16
  2. For LHW-4, LCW-4, CW-4, HW-4, AW-4 water lines, follow schedules P-8.1 and P-8.2.
  3. For CS, refer to Section 22 36 00 CHEMICAL SHOWER SYSTEM.
  4. For BA, refer to Section 22 64 00 BREATHING AIR SYSTEM.
  5. For CO2 gas, follow Schedule P-8.10.
  6. For O2 gas, follow Schedule P-8.6.

SCHEDULE P-5.1

A. Service:

1. Domestic use water above grade 4 inch and smaller.
2. Laboratory use water above grade 4 inch and smaller.
3. Softened water above grade 4 inch and smaller.
4. Tempered water.
5. RO reclaim (rejected) water.

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Pipe: Type L hard drawn seamless copper tubing, ASTM B88. All components of system shall conform to NSF 61.

D. Joints: Soldered with alloy HB lead-free solder; ASTM B32, AWS A5.8/A5.8M.

E. Fittings: Wrought copper, soldered ends; ASME B16.22.

F. Flanges: 150 psi, flat face with insulating bolt sleeves and washers, cast bronze; ASME B16.18.

G. Gaskets: Full face, 1/8 inch thick rubber, gasket ID must match pipe ID.

H. Ball Valves, 2 Inch and Smaller: 600 psi WOG serviceable in line, three piece bronze body, full port, soldered connections, stainless steel ball, TFE seats, fluorocarbon rubber seals, extended lever handle; MSS SP-110. For tempered water system, provide valve handle with locking feature.

J. Gate Valves:

1. 3 Inch: Class 125, 200 psi WOG, bronze, non-rising stem, soldered ends.
2. 4 Inch: Class 125, 200 psi WOG, cast iron, non-rising stem, , FF flanged ends.

K. Check Valves:

1. 2 Inch and Smaller: Class 125, 250 psi WOG, bronze, spring load type check, renewable bronze disc, soldered connections.
2. 3 Inch and 4 Inch: Class 125, 200 psi WOG, bronze, spring load type check, renewable bronze disc and plugs, flanged ends.

L. Butterfly Valves, 3 Inch and 4 Inch: 200 psi WOG, ductile iron body lug style, aluminum bronze disc, EPDM seat, multi-position locking handle.

M. Globe Valves: Class 150, bronze, soldered ends, union bonnet, renewable seat and disc.

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- N. Drain Valves: 1/2 Inch and 3/4 inch: 600 psi WOG, two piece bronze body, full port, soldered connection on one end and 3/4 inch hose connection with cap and chain on the other, stainless steel ball, TFE seats and packing, extended lever handle; MSS SP-110.
- O. Dielectric fittings: Unions; Female threaded by solder ends, zinc plated steel, brass and copper. Flanges: Female iron pipe thread by solder connections, grey iron, steel, brass and copper, complete with gasket, insulating washers, bolt insulators and hardware. Waterways: Zinc electroplated steel pipe with high temperature stabilized polyethylene liner, threaded or grooved ends.
- P. Test and Clean: Follow Schedule P-8.1.
- Q. Disinfect: Follow Schedule P-8.2.

SCHEDULE P-5.2

- A. Service: Indirect waste.
- B. Maximum Design:
  - 1. Pressure: Atmosphere.
  - 2. Temperature: 140 degrees F.
- C. Pipe; 2 Inch and Smaller: Type DWV copper drainage tubing; ASTM B306.
- D. Joints: Soldered with grade HB lead-free solder; ASTM B32, AWS A5.8/A5.8M.
- E. Fittings: Cast bronze, drainage; ASME B16.23.
- F. PVC Piping: For condensate drain piping in unfinished mechanical space only. Schedule 80 CPVC; ASTM D2846/D2846M, ASTM F441/F441M and ASTM D1784. Socket type solvent welded fittings.
- G. In finished areas: Type 304 stainless steel, mill finish.
- H. Test and Clean: Follow Schedule P-8.4.

SCHEDULE P-5.3

- A. Service: Water Trap Priming 1/2 inch.
- B. Maximum Design:
  - 1. Pressure: 150 psig.
  - 2. Temperature: 150 degrees F.
- C. Pipe: Type L, annealed, soft temper copper coil, ASTM B88.
- D. Test and Clean: Follow Schedule P-8.1.

SCHEDULE P-5.4

A. Service:

1. Laboratory vacuum.
2. Laboratory vacuum exhaust.

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Pipe: Type L hard drawn seamless copper tubing; ASTM B88.

D. Joints: Solder with grade HB lead-free solder; ASTM B32, AWS A5.8/A5.8M.

E. Fittings: Wrought copper soldered ends; ASME B16.22.

F. Shut-off, Zone, and Riser Valves: 600 psi WOG, three piece bronze body, soldered connections, stainless steel ball and trim, full port, Teflon seals, seat and O-ring packing, lever handle; FS WW-V-35.

G. Drain Valves: 1/2 Inch and 3/4 inch: 600 psi WOG, two piece bronze body, full port, soldered connection on one end and 3/4 inch hose connection with cap and chain on the other, stainless steel ball, TFE seats and packing, lever handle; MSS SP-110.

H. Test and Clean: Follow Schedule P-8.5.



SCHEDULE P-5.5

- A. Service: Carbon dioxide gas.
- B. Maximum Design:
  - 1. Pressure: 150 psig.
  - 2. Temperature: 150 degrees F.
- C. Tubing: Hard drawn seamless copper tubing, factory oxygen cleaned, nitrogenized, capped and bagged, Type K; ASTM B819.
- D. Joints: Brazed with alloy, classification BCuP5 (15 percent silver, 5 percent phosphorous, 80 percent copper), with continuous nitrogen gas purge; AWS A5.8/A5.8M.
- E. Fittings: Wrought copper, solder cup ends, factory oxygen cleaned, nitrogenized, capped and bagged; ASTM B88, ASME B16.22.
- F. Ball Valves, 2 Inch and Smaller: 600 psi WOG, three piece bronze body, full port, copper tube stub ends, stainless steel ball, TFE seats and packing, lockable lever handle; MSS SP-110, oxygen cleaned.
- G. Test and Clean: Follow Schedule P-8.10.
- H. Check Valves, 2 inches and smaller: 1500 psig, spring and poppet type, brass three piece body, double ferrule compression joint ends, 1 psig crack pressure, buna N O-ring, PTFE coated stainless steel gaskets, oxygen cleaned.

SCHEDULE P-5.8

A. Service:

1. Argon gas.
2. Helium gas.
3. WAGD vacuum.

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Tubing: Hard drawn seamless copper tubing, factory oxygen cleaned, nitrogenized, capped and bagged, Type K; ASTM B819.

D. Joints: Brazed with alloy classification BCuP5 (15 percent silver, 5 percent phosphorous, 80 percent copper), with continuous nitrogen gas purge; AWS A5.8/A5.8M.

E. Fittings: Wrought copper, solder cup ends, factory oxygen cleaned, nitrogenized, capped and bagged; ASME B16.22.

F. Ball Valves: 400 psi WOG, three piece bronze body, with tubing extensions, stainless steel ball, full port, Teflon seal, seat and O-ring packing, lever handle, factory oxygen cleaned and capped; MSS SP-10.

G. Test and Clean: Follow Schedule P-8.6.

SCHEDULE P-5.9

- A. Service: Medical oxygen gas.
- B. Maximum Design:
  - 1. Pressure: 150 psig.
  - 2. Temperature: 150 degrees F.
- C. Tubing: Hard drawn seamless copper tubing, Type K; ASTM B819. Identified by marking "OXY/MED" in green.
- D. Joints: Brazed with alloy classification BCuP5 (15 percent silver, 5 percent phosphorous, 80 percent copper), with continuous nitrogen gas purge; AWS A5.8/A5.8M.
- E. Fittings shall be wrought, brass or bronze designed expressly for brazed connection. ANSI/ASME B16.22.
- F. Ball Valves: 400 psi WOG, three piece bronze body, with tubing extensions, stainless steel ball, full port, Teflon seal, seat and O-ring packing, lever handle, factory oxygen cleaned and capped; MSS SP-10.
- G. Tubing, fittings, valves, and other components shall be specially cleaned for oxygen service in a facility equipped to clean, rinse, and purge in accordance with the requirements of NFPA 99 and received on job site cleaned, capped and bagged. On site cleaning of the interior surface of tubes, valves, fittings, and other components is not allowed.
- H. Test and Clean: Follow Schedule P-8.6.

SCHEDULE P-5.13

A. Service:

1. Laboratory compressed air 4 inch and smaller.
2. High pressure compressed air 4 inch and smaller.
3. Laboratory nitrogen gas 4 inch and smaller.
4. Laboratory oxygen 4 inch and smaller.

B. Maximum Design:

1. Pressure: 150 psig.
2. Temperature: 150 degrees F.

C. Pipe: Hard drawn seamless copper tubing, factory oxygen cleaned, nitrogenized, capped and bagged, Type L; ASTM B819.

D. Joints: Brazed with alloy classification BCuP5 (15 percent silver, 5 percent phosphorous, 80 percent copper), with continuous nitrogen gas purge; AWS A5.8/A5.8M.

E. Fittings: Wrought copper, solder cup ends, factory oxygen cleaned, nitrogenized, capped and bagged; ASME B16.22.

F. Flanges: 150 pound, cast bronze; ASME B16.18.

G. Ball Valves; 2 Inch and Smaller: 600 psi WOG, two piece bronze body, full port, soldered connections, stainless steel ball, TFE seats and packing, lever handle; FS WW-V-35.

H. Gate Valves; 3 Inch and 4 Inch: Iron body, bronze trim, full port, flanged ends, 200 psi WOG.

I. Globe Valves: Class 150, bronze, soldered ends, union bonnet, renewable seat and disc.

J. Check Valves:

1. 2 Inch and Smaller: Class 125, 200 psi, bronze, swing check, renewable bronze disc, threaded connections; MSS SP-80.
2. 3 Inch and 4 Inch: Class 125, 200 psi, bronze, swing check, renewable bronze disc and plugs, flanged ends.

K. Drain Valves: 1/2 Inch and 3/4 inch: 600 psi WOG, two piece bronze body, full port, soldered connection on one end and 3/4 inch hose connection with cap and chain on the other, stainless steel ball, TFE seats and packing, lever handle; MSS SP-110.

L. Test and Clean: Follow Schedule P-8.6.

SCHEDULE P-5.14

- A. Service: Breathing Air.
- B. Refer to Section 22 64 00 BREATHING AIR SYSTEMS for piping specification.

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SCHEDULE P-5.15

- A. Service: Solar Water Heating Equipment.
- B. Refer to Section 22 33 30.00 10 SOLAR WATER HEATING EQUIPMENT for piping specification.

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SCHEDULE P-6.1

A. Service:

1. Laboratory waste above grade.
2. Laboratory indirect waste.

B. Maximum Design:

1. Pressure: Gravity vented.
2. Temperature: 180 degrees F.

C. Pipe:

1. Schedule 40, Polypropylene Pipe; ASTM D4101 Flame retardant; D635.
2. For cagewash areas and from floor drains at sterilizers (as indicated on floor plans): Schedule 40, PVDF pipe; ASTM D3222 Flame retardant, marked with UL 723 classified.

D. Joints: Mechanical for accessible sink traps and for accessible piping within laboratory rooms. Use electrical resistance fusion joints elsewhere.

E. Fittings:

1. Schedule 40 Polypropylene; ASTM D4101, flame retardant.
2. Schedule 40 PVDF; ASTM D4101, flame retardant.

F. Test and Clean: Follow Schedule P-8.4.

SCHEDULE P-6.2

- A. Service: Detergent Dispensing System.
- B. Maximum Design:
  - 1. Pressure: 70 psig.
  - 2. Temperature: 70 degrees F.
- C. Tubing and Conduit:
  - 1. Tubing: Semi-rigid virgin polypropylene tubing, meets UL 94 HB burn rated; NSF 61.
  - 2. Conduit: Schedule 40, rigid PVC electrical conduit with swaged socket end; CSA C22.2 No. 211.2.
- D. Joints and Fittings:
  - 1. Joints and Fittings (Tubing): PFA fluoropolymer body, ferrule and nut compression fittings;
  - 2. Joints and Fittings (Conduit): Solvent cemented joints using a primer and solvent cement, Schedule 40, rigid PVC standard radius bends.
- E. Pull Boxes: Rigid PVC with PVC cover, use solvent cemented junction box adaptors to connect to conduit.
- F. Shut-off Valves: True-union, polypropylene ball valve, full port, Teflon seals, threaded ends.
- G. Check Valves: Polypropylene, ball check valve, threaded ends.
- H. Test and Clean (tubing): Follow Schedule P-8.16.
- I. Test and Clean (conduit): Follow Schedule P-8.15.



SCHEDULE P-6.3

- A. Service: RO Purified water.  
Emergency Animal Water Supply
- B. Maximum Design:
1. Pressure: 150 psig.
  2. Temperature: 68 degrees F.
- C. Materials: Pre-clean all material and deliver in sealed polyethylene bags.
- D. Pipe: Polypropylene Pipe shall be manufactured from a Group 1, Class 2 Beta Polypropylene Homopolymer material manufactured to SDR 11, IR (infra red) connections. Provide tubing capped. ASTM Standards, ASTM D4101, ASTM D638, ASTM D2837, ASTM D2122, and shall conform to FDA 21 CFR 177.1520, USP 25 Class VI and ASME-BPE.

SDR 11 Pipe Dimensions

NOMINAL SIZE	PIPE WALL
1/2 inch	1.9 mm
3/4 inch	2.3 mm
1 inch	3.0 mm
1 1/4 inch	3.7 mm
1 1/2 inch	4.6 mm
2 inch	5.8 mm
2 1/2 inch	6.9 mm
3 inch	8.2 mm

- E. Joints: IR butt welded.
- F. Fittings: Same as pipe material.
- G. Ferrules: Same as pipe material, sanitary ends with stainless steel clamp type connections, EPDM O-ring gaskets.
- H. Pipe Unions: Same as pipe material, 3 piece, high purity pipe union with EPDM O-ring gaskets.
- I. Clamps: 3-piece, pipe-union. High purity, Kynar construction.
- J. Gaskets: Standard molded one piece EPDM O-ring.
- K. Diaphragm Valves: Diaphragm valves shall be constructed of polypropylene with EPDM or PTFE Seal configurations.
- L. Check Valves: Ball type polypropylene true union check valves, with welded sanitary ends suitable for clamp type connections, viton ring seal.
- M. In-Line Flow Tube: In-line type, welded sanitary ends suitable for clamp type connections, polysulphone tube, PVDF float, EPDM O-rings, maximum working temperature 150 degrees F.
- N. Pressure Regulators: Polypropylene body, with welded sanitary ends

suitable for clamp type connections, inlet pressures 150 psi at 75 degrees F, with downstream pressure range 80 psi to 20 psi EPDM seals, cadmium plated steel spring, EPDM diaphragm.

- O. Electric Valves: Weir type natural polypropylene body, welded sanitary ends suitable for clamp type connections, glass filled polypropylene actuator housing, bronze bushings and compressor, EPDM diaphragm, EPDM backing cushion and stainless steel tube nut assembly, fail closed.
- P. Zero Static Valve: "Zero static" diaphragm valve, with multi-turn, rising stem. Shortest possible branch geometry for "zero" dead leg, Ends for IR fusion, molded PVDF body with outstanding internal surface characteristics for the ultimate in high purity design, PTFE (EPDM backed) diaphragms.
- Q. Self-closing valve: 316 stainless steel valve body, stem and handle with PTFE coated spring, straight pattern, FPM o-ring steam seal, soft-seat shut-off, 200 psi WOG.
- R. Testing and Cleaning: Follow Schedule P-8.16.
- S. Disinfecting: Follow Schedule P-8.16.
- T. Pressure Gauges: 3-5/8 inch sanitary type pressure gauge, range from 0 to 160 psig. 1-1/2 inch clamp type fitting, bottom mounting, measuring element having 80/20 standard fill with glycerine filled case, 304 stainless steel case with all wetted surfaces 316 (low carbon) stainless steel.
- U. Thermometers: 10 inch sanitary type thermometer, 5 inch bulb, range from 20 to 220 degrees F, 1-1/2 inch clamp type fitting, polycarbonate crystal, suitable for mounting in pipeline.

SCHEDULE P-6.4

- A. Service: APR Door Pneumatic Piping.
- B. Maximum Design:
  - 1. Pressure: 90 psig.
  - 2. Temperature: 70 degrees F.
- C. Building Distribution Piping (up to VCC panel): Same as schedule P-5.13.
- D. Tubing and Conduit from VCC panel to Junction Box in APR door framing:
  - 1. Tubing: 8mm by 1.25mm (equivalent to nominal 1/4 inch), flexible polyurethane tubing.
  - 2. Outer Conduit: Refer to Specification 26 20 00.
  - 3. Inner Conduit: Refer to Specification 26 20 00.
- E. Joints and Fittings:
  - 1. Joints and Fittings (Tubing): push-in fittings.
  - 2. Joints and Fittings (Conduit): Refer to specification 26 20 00.
- F. Single seal APR door Pneumatic Piping: One active tubing and one spare tubing sleeved in conduits.
- G. Double seals APR door Pneumatic Piping: Two active tubing and two spare tubing sleeved in conduits.
- H. Refer to specification 26 20 00 for the installation requirement for APR door pneumatic piping serving APR door in BSL-3E and BSL-4 labs.
- I. Test and Clean (tubing):
  - 1. Cleaning: Purge internals of system with clean dry compressed air of sufficient quantity that will dislodge sediment or dirt.
  - 2. Testing: Test system at 20 percent above design pressure, with dry oil-free compressed air. Hold test for 2 hours with source shut-off valve closed.
- J. Test and Clean (conduit): Follow Schedule P-8.3.

SCHEDULE P-6.5

- A. Service: Laboratory waste below grade.
- B. Maximum Design:
  - 1. Pressure: Atmosphere.
  - 2. Temperature: 180 degrees F.
- C. Pipe: Schedule 40, polypropylene pipe; ASTM D4101, non-flame retardant.
- D. Joints: Electric resistance fusion joints.
- E. Fittings: Schedule 40 polypropylene; ASTM D4101.
- F. Test and Clean: Follow Schedule P-8.4.

SCHEDULE P-7.5

- A. Service: Brine
- B. Maximum Design:
  - 1. Pressure: 150 psig
  - 2. Temperature: 275 degrees F.
- C. Pipe: Fiberglass reinforced plastic (FRP): 1 inch to 2 inch, Schedule 40, plain ends, filament wound reinforced thermosetting resin pipe, raw materials shall be industrial grade. Constructed of three specific layers; 60 mil thick, double synthetic veil reinforced 90 percent maximum epoxy resin aromatic amine cured internal corrosion barrier, filament wound 65 percent glass reinforcement or cage of continuous roving at 54-3/4 degrees with epoxy resin, 50 mil thick synthetic veil reinforced external corrosion/UV barrier; ASTM D2996 Class 1 filament wound, Grade 1 glass fiber reinforced epoxy resin, Class F epoxy, ASTM D2310.
- D. Joints: Straight socket adhesive bonded. Two component, pre-measured and ready to mix recommended for pipe materials.
- E. Fittings: Matching pipe materials, factory molded or fabricated, drainage patterns.
- F. Flanges: FRP matching pipe materials, 150 lb bolt pattern; ANSI/ASME B16.5.
- G. Hardware: Grade B 304 SS heavy hex machine bolts, each with Grade A heavy hex nuts and washers.
- H. Gaskets: Class 150, 1/8 inch thick, full face, EPDM, Shore A hardness of 50 to 70, ASME B16.21.
- I. Valves:
  - 1. Ball valves: Size 1 inch to 2 inch: FRP ball valve with flanged ends with PTFE seats and EPDM seals and backing rings, handle locking attachment.
  - 2. Swing check valves: Size 1 inch to 10 inch: Swing check valve, top entry, FRP body, Viton seats and seal, flanged ends.
- J. Test and Clean: Follow Schedule P-8.1

SCHEDULE P-7.6

- A. Service: Biowaste/Vent (Below Grade)
- B. Maximum Design:
  - 1. Pressure: Gravity Vented.
  - 2. Temperature: 180 degrees F.
- C. Pipe: Double wall fiberglass reinforced plastic (FRP):
  - 1. Inner Pipe: 1 inch to 10 inch, Schedule 40, plain ends, filament wound reinforced thermosetting resin pipe, raw materials shall be industrial grade. Constructed of three specific layers; 60 mil thick, double synthetic veil reinforced 90 percent maximum epoxy resin aromatic amine cured internal corrosion barrier, filament wound 65 percent glass reinforcement or cage of continuous roving at 54-3/4 degrees with epoxy resin, 50 mil thick synthetic veil reinforced external corrosion/UV barrier; ASTM D2996 Class 1 filament wound, Grade 1 glass fiber reinforced epoxy resin, Class F epoxy, ASTM D2310.
  - 2. Outer Pipe: 4 inch to 14 inch, Schedule 30, plain ends, filament wound reinforced thermosetting resin pipe, raw materials shall be industrial grade. Constructed of three specific layers; 30 mil thick, double synthetic veil reinforced 90 percent maximum epoxy resin aromatic amine cured internal corrosion barrier, filament wound 65 percent glass reinforcement or cage of continuous roving at 54-3/4 degrees with epoxy resin, synthetic veil reinforced external corrosion/UV barrier; ASTM D2996 Class 1 filament wound, Grade 1 glass fiber reinforced epoxy resin, Class F epoxy, ASTM D2310.
- D. Joints: Straight socket adhesive bonded. Two component, pre-measured and ready to mix recommended for pipe materials.
- E. Spiders or spacers: Concentric spacing matching inner and outer pipe materials, with large opening along bottom 1/3 of pipe diameter for leak detection cable, venting and draining of containment pipe.
- F. Fittings: Double wall matching pipe materials, unrestrained spiders or spacers, factory molded or fabricated, drainage patterns. Closure fittings shall have 3/4 or 1 IN threaded inspection/pull port.
- G. Flanges: FRP matching pipe materials, 150 lb bolt pattern; ANSI/ASME B16.5.
- H. Hardware: Grade B 304 SS heavy hex machine bolts, each with Grade A heavy hex nuts and washers.
- I. Gaskets: Class 150, 1/8 inch thick, full face, EPDM, Shore A hardness of 50 to 70, ASME B16.21.
- J. Valves:
  - 1. Ball valves: Size 1 inch to 2 inch: FRP ball valve with flanged ends with PTFE seats and EPDM seals and backing rings, handle locking attachment.

2. Butterfly Valves: Size 2-1/2 inch to 10 inch FRP body and disc, EPDM seat. Lever handle to 4 inch size, gear operator for 6 inch and larger, with handle locking attachment.
3. Swing check valves: Size 1 inch to 10 inch: Swing check valve, top entry, FRP body, Viton seats and seal, flanged ends.
- K. Containment Inspection Ports: Fabricated FRP matching pipe materials, flanged or socket ends, flanged top with inspection/access manway and provisions for leak detection cable access.
- L. Leak Detection System: For leak detection cable and monitoring system see Division 23.
- M. Test and Clean:
  1. Inner (Carrier): Follow Schedule P-8.4.
  2. Outer (Containment): Follow Schedule P-8.16.

SCHEDULE P-8.1

A. Applies to Schedules: P-3.3, P-3.5, P-5.1, P-5.12, P-4.8, P-5.3, P-7.5, P-7.6.

B. System Flushing:

1. During Flushing: Before operational tests or disinfection, potable water piping system shall be flushed with cold potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.
2. After Flushing: System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 50.12 Part 141.80(c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.
3. Remove flow indicators and flow measuring devices before flushing. Replace after cleaning is completed.

C. Hydrostatic Test:

1. Remove pipe system devices not designed to withstand specified test pressure.
2. After flushing, fill system with water, venting off entrapped air at high points of system.
3. Apply hydrostatic pressure to one and one-half times design



pressure or 150 psig, whichever is greater. Test pressure for Schedules shall not exceed maximum design pressure.

4. Hold test pressure for 4 hours. Systems will be inspected to determine visible leaks or significant pressure variations. (Temperature variations must be considered.)
5. When hydrostatic test is approved, drain water to storm sewer.
6. Dismantle, clean and reinstall drain valves and strainers.
7. Tabulate and submit test results.
8. Reinstall pipe system devices.

D. Repair of Leaks:

1. Mechanical or Threaded Joints:
  - a. Tighten joints using discretion or
  - b. Take joint apart and replace defective material.
2. Soldered Joints: Take joint apart, clean both tube and fitting, and remake joint.
3. Welded Joints:
  - a. Remove defective weld metal by chipping, grinding, or flame gouging. Reweld following new work procedure in accordance with ASME B31.3.
  - b. Do not repair by adding weld metal to defective area.
4. Plastic Joints: Take joint apart and replace with new material.
5. Retest after repairs.

SCHEDULE P-8.2

A. Applies to Schedules: P-2.1, P-3.5, P-4.8, P-5.1.

B. Disinfecting:

1. Provide 3/4 inch hose connection in water main entering building for disinfecting purposes.
2. Verify quality of water supply used prior to proceeding.
3. Unless otherwise required by governing authorities, disinfect new water lines as follows.
  - a. Pump sufficient sodium hypochlorite or liquid chlorine into water main to produce a free available chlorine residual of not less than 50 ppm throughout system. Isolate the stainless steel animal watering system from the disinfection solution. The stainless steel piping can only see a maximum of 50 ppm.
  - b. Proceed upstream from point of chlorine application, opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
  - c. When chlorinated water has been brought to every faucet and tap, retain water in system for at least 24 hours.
  - d. At end of retention period, open all faucets and taps, and thoroughly flush until chlorine residual is less than 1.0 ppm.
  - e. Have water samples analyzed by an approved bacteriological laboratory, for total coliform organisms in accordance with AWWA 10084.
  - f. When all samples tested conform to applicable regulations, submit certification of successful completion.
4. If any samples tested indicate presence of coliform organisms, repeat entire procedure.

SCHEDULE P-8.3

- A. Applies to Schedules: P-1.1, P-6.4.
- B. Cleaning: Flush internals of system with water of sufficient velocity to dislodge sediment and dirt.
- C. Hydrostatic Test:
  - 1. Test Pressure: 10 feet of water.
  - 2. Hold test pressure for 30 minutes without visible leak or significant pressure or level variations. Temperature fluctuations must be considered. Joints will be inspected.
- D. Final Air Test (Unless Waived): Fill traps or plug openings with water. Apply air pressure equivalent to one inch of water column. System must contain pressure for 15 minutes.
- E. Tabulate and submit test results.

SCHEDULE P-8.4

- A. Applies to Schedules: P-1.2, P-5.2, P-6.1, P-6.5.
- B. Cleaning: Flush internals of system with water of sufficient velocity to dislodge sediment and dirt.
- C. Hydrostatic Test:
  - 1. Test Pressure: 10 feet of water.
  - 2. Hold test pressure for 30 minutes without visible leak or significant pressure or level variations. Temperature fluctuations must be considered. Contracting Officer will inspect joints.
- D. Each vertical stack, with its branch waste and vent pipes, may be tested separately by plugging openings at base of stack.
- E. Final Smoke Test (Unless Waived): After all plumbing fixtures have been set, and traps filled with water, test connections to prove gastight and watertight, as follows:
  - 1. Fill traps with water. Introduce a thick pungent smoke, produced by smoke machines(s), into entire system. When smoke appears at stack openings on roof, close vents and maintain pressure equivalent to 1 inch water column throughout inspection.
  - 2. If Contracting Officer finds that a smoke test is impractical, a peppermint test is acceptable.
- F. Tabulate and submit test results.

SCHEDULE P-8.5

A. Applies to Schedules: P-4.1, P-5.4.

B. Cleaning:

1. Flush internals of system with water of sufficient velocity and quantity to dislodge sediment or dirt.
2. Remove flow indicators or flow measuring devices before flushing. Replace after cleaning is completed.
3. System may be tested in sections. Record information on installation and removal of blanks, plugs, or caps. Remake joints that were blanked or plugged.

C. Hydrostatic Test:

1. Remove pipe system devices not designed to withstand specified test pressure. Replace after testing is completed.
2. After flushing, fill system with water, venting off entrapped air at high points of system.
3. Apply hydrostatic pressure to one and one-half times design pressure or 50 psig, whichever is greater.
4. Hold test pressure for 4 hours. AE, Contractor, and Government will inspect to determine whether there is a visible leak or significant pressure variation. (Temperature variations must be considered).
5. When hydrostatic test is approved, drain water to storm sewer. For piping systems with Victaulic gaskets properly vent system before draining to prevent gasket displacement.
6. Dismantle, clean, and reinstall drain valves and strainers.

D. Tabulate and submit test results.

E. Repair of Leaks:

1. Welded Joints:

a. Remove defective weld metal by chipping, grinding, or flame gouging. Reweld following new work procedure as indicated by ASME B31.1.

b. Do not repair by adding weld metal to defective area.

2. Threaded Joints:

- a. Tighten joints using discretion; or
- b. Take joint apart and replace defective material.
- c. Do not use caulk.

3. Soldered Joints: Take joint apart, clean both tube and fitting, and remake joint.

4. Grooved Joints: Take joint apart, clean, and check gasket is properly in place. Reassemble.
5. Retest system after repairs.

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SCHEDULE P-8.6

- A. Applies to Schedules: P-4.8, P-5.8, P-5.9, P-5.13. Unless otherwise required by NFPA 99, test piping in accordance with this Schedule.
- B. Cleaning: After installation, but prior to connecting service outlets, blow system clear with dry oil-free nitrogen gas.
- C. Test Instruments: Provide vacuum gages with one inch Hg increments, readable to 1/2 inch Hg. Provide pressure gages with one psig increments, readable to 1/2 psig. Use only correct adapters for gages. Do not use universal adapters.
- D. Pressure Test Gases: During initial purging, blowing out, and pressure testing, use only oil-free dry nitrogen conforming with CGA G-10.1, Grade F, except that hydrocarbons and halogenated hydrocarbons shall not exceed the limits in Table 2, "Test Gas Purity, Contaminate Levels, and Test Methods." Use no other gas, material, or liquid during purging and tests.
- E. Outlet Adapters: Use only correct adapters for specified medical gas outlets. Do not use universal adapters.
- F. Positive Pressure Tests: Test only one system at a time. Test each joint with soap solution, repair leaks found, and retest. In the systems not being tested, install pressure gages, bleed to zero pressure, and seal. Investigate the cause of significant pressure rise in the systems not being tested.
  - 1. Leak Tests, Low Pressure Systems: Less than 600 psig. Test each section of each system at 150 to 200 psig with oil-free dry nitrogen. When design pressure is greater than 200 psig, pressurize each section in 50 psig increment until the design pressure is reached.
  - 2. Leak Tests, High Pressure Systems: 600 - 3000 psig. Before attaching service outlets, couplers or other equipment, pressurize each section in 200 psig increments with oil-free dry nitrogen until the design pressure is reached. Leak test joints with soap solution at each 200 psig increment.
  - 3. Equipment Pressure Tests: Test joints with the system at 150 psig with the equipment connected limited to the rough-in portion of service outlets. Do not connect equipment until after the test is completed. Carefully wipe off soapsuds and seal openings against contamination until tanks or equipment are connected.
  - 4. Final Pressure Tests, Low Pressure Systems: Pressure test with nitrogen at 120 percent of design pressure for 24 hours. No pressure drop, except due to temperature change, will be accepted. Allow for ambient temperature change in accordance with the relationship  $PF + 14.7 = (P_1 + 14.7) (T_2 + 460) / (T_1 + 460)$ , in which T and P represent Fahrenheit temperature and gage pressure respectively, numbers 1 and 2 denote initial and final readings respectively, and PF is the calculated final pressure. When PF exceeds the measured final pressure, retest each section individually, and apply soap solution to all joints of each section for which a reduction in pressure occurs after allowing

for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. Use a test gage calibrated in one psi increments and readable to 1/2 psig.

5. Final Pressure Tests, High Pressure Systems: Pressurize system with nitrogen in 200 psig increments. Hold design pressure for 24 hours. No pressure drop, except due to temperature change, will be accepted. Allow for ambient temperature change in accordance with the relationship  $PF + 14.7 = (P1 + 14.7) (T2 + 460) / (T1 + 460)$ , in which T and P represent Fahrenheit temperature and gage pressure respectively, numbers 1 and 2 denote initial and final readings respectively, and PF is the calculated final pressure. When PF exceeds the measured final pressure, retest each section individually, and apply soap solution to all joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. Use a test gage calibrated in 50 psig increments and readable to 25 psig in performing the tests.
- G. Vacuum Systems Tests: Test vacuum, anesthesia gas evacuation, and oral evacuation systems.
1. Leak Tests: After installation of outlet valves but before installing vacuum pumps and alarm switches, pressurize each section of each system with oil-free dry nitrogen to 60 psig and test with soap solution. Repair leaks and retest.
  2. Final Pressure Tests: Pressurize system with oil-free dry nitrogen to 25 psig for 24 hours. No pressure drop, except due to temperature change, will be accepted. Allow for ambient temperature change in accordance with the relationship  $PF + 14.7 = (P1 + 14.7) (T2 + 460) / (T1 + 460)$ , in which T and P represent Fahrenheit temperature and gage pressure respectively, numbers 1 and 2 denote initial and final readings respectively, and PF is the calculated final pressure. When PF exceeds the measured final pressure, retest each section individually, and apply a soap solution to all joints of each section in which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. Use a test gage calibrated in one psi increments and readable to 1/2 psig.
  3. Vacuum Tests: After the installation of alarm switches, evacuate each system to 17 inches Hg, or to the indicated inches Hg for oral evacuation system, and test each outlet's pressure (vacuum) with a test gage calibrated in one inch Hg increments and readable to 1/2 inch Hg.
  4. Cleaning: Carefully wipe off soapsuds and seal openings against contamination until tanks or equipment are connected.
- H. Cross-Connection Tests by Testing Agency: Comply with NFPA 99. Pressurize each system with nitrogen in accordance with Table 1. Check 100 percent of the outlets in each system. Include anesthesia gas evacuation in vacuum systems. Do not include the oral evacuation systems in these tests.



TABLE 1

## CROSS-CONNECTION TEST PRESSURES

<u>System</u>	<u>psig</u>
Vacuum	10
Nitrogen	30
Nitrous Oxide	40
Oxygen	50
Medical Air	60

- I. Medical Air Compressor and Vacuum Pump Tests by Testing Agency: Operationally test each unit through their respective pressure and capacity ranges. Test control operations from start-up, low through high speeds, shut-down and emergency functions and safety limits. Check each unit for conformance with the indicated or specified performance requirements. Test medical air from compressor dryer/filter systems for contaminants in accordance with paragraph entitled "Medical Air Purity, Contaminate Levels, and Test Methods."
- J. Bulk Liquid Oxygen System Tests by Testing Agency: Check and operate the systems for conformance with NFPA 55 and NFPA 99, the manufacturer's written performance specifications, and the indicated and specified requirements.
- K. Component Tests by Testing Agency: Test system controls, alarms, pressure switches, and equipment operations. Verify the flow rate accuracy of each pressure reducing regulator.
- L. Final Purging and Testing by Testing Agency: Use 60 to 65 psig, oil-free dry nitrogen to purge and clean medical air, oxygen, nitrogen, and nitrous oxide system 24 hours continuously for a minimum of 24 hours. Allow purge nitrogen to impinge upon a white cloth at a minimum flow rate of 3.50 cfm, until no evidence of discoloration is present and test gas used during the previous gas test has been removed from the piping systems. Bleed source gas for a minimum of one minute continuously through each terminal copper piping installed, as specified. After completion of purging and cleaning, completely remove temporary piping, adaptors, and connectors.
- M. System Contaminant Level Tests by Testing Agency:
1. Test Gases: After final purging and cleaning, use test gases as specified in paragraph entitled "Test Gas Purity, Contaminate Levels, and Test Methods," and provided by the Government, to test for contamination in medical air, oxygen, nitrogen, and nitrous oxide systems. For medical air system tests, use medical air as test gas specified in paragraph entitled "Medical Air Purity, Contaminate Levels, and Test Methods." Minimum flow rate of test gas shall be 100 liters per minute.
  2. Test Gas Purity, Contaminate Levels, and Test Methods: Table 2 lists limits of contaminants or concentration minimums in the test gases used for purging and testing in oxygen, nitrogen, and nitrous oxide systems, and test methods to be used to determine levels of contaminants and concentration minimums.

TABLE 2

TEST GAS PURITY, CONTAMINATE LEVELS,  
AND TEST METHODS

- a. Test Gas: 99 percent by volume minimum; gas chromatography or equivalent.
  - b. Solid Particulate: 2 milligrams per cubic meter maximum; 0.8 micron pore size filter.
  - c. Hydrocarbon Compounds: One part per million, concentration volume per volume, maximum expressed as methane equivalents; gas chromatography or equivalent.
  - d. Halogenated Hydrocarbon Compounds: 2 parts per million, concentration volume per volume, maximum; mass spectrometry, infrared spectrometry, or gas chromatography.
  - e. Carbon Monoxide: 2 parts per million, concentration volume per volume, maximum; gas chromatography, electrochemical carbon monoxide analyzer, or equivalent.
  - f. Water (Moisture): Minus 58 degrees F dew point; Pittsburg cup, dew point hygrometer, or electronic hygrometer.
3. Medical Air Purity, Contaminate Levels, and Test Methods: Determine medical air purity and contaminate levels by testing air quality at the compressor, but before air is allowed to enter piping system. Test air samples from each medical air system including air intake areas, filter/dryer equipment outlets, and specified system outlets. Limit solid particulate levels below the specified filter efficiency levels. Limit moisture levels below that of the specified dryer outlet dew point. Use test methods specified in paragraph entitled "Test Gas Purity, Contaminate Levels, and Test Methods."
  4. Contamination Tests: Test gas sources, equipment outlets, and system outlets using test methods specified in paragraphs entitled "Test Gas Purity, Contaminate Levels, and Test Methods," and entitled "Medical Air Purity, Contaminate Levels, and Test Methods."
  5. Gas Source Tests: Test gas and air sources for contamination and gas concentrations. Purge oxygen, medical gas, nitrous oxide, and nitrogen systems with an appropriate gas until gases reach specified concentrations, clean and free of contamination. Care must be taken to vent purged nitrous oxide and oxygen to the outside of the building and away from flames.
  6. 100 Percent Testing: Test 100 percent of the medical gas outlets in rooms which are supplied with nitrous oxide or nitrogen.
  7. 10 Percent Testing: Test 10 percent of the medical gas outlets in areas which are supplied only with oxygen or medical air. Test such outlets to ensure the gas traversed the greatest length of pipeline.

8. Contaminated Systems: Clean and retest contaminated sections with one or more contaminated outlets. In rooms or areas where only oxygen or medical air is supplied, retest 20 percent of the outlets including the original 10 percent first tested. Each time contamination is found, repeat cleaning operation and increase number of outlets tested by 10 percent until zero percent contamination is obtained. Take care to vent purged nitrous oxide and oxygen to outside of building, away from flames.
- N. Holding Charges by Testing Agency: After successful completion of contamination and gas concentration tests, pressurize each system to the operating pressure with the appropriate gas, shutoff valves, and cap outlets to keep systems free of contamination.
- O. Final Alarm Tests by Testing Agency: Test and operate switches, alarms, and controls in each system with appropriate medical gases.
- P. Repairs of Leaks:
  1. Brazed Joints: Take joint apart, clean both tube and fitting, and remake joint.
  2. Retest after repairs.

SCHEDULE P-8.10

- A. Applies to Schedules: P-4.2, P-4.8, P-5.5.
- B. Cleaning:
  - 1. Purge internals of system with clean dry compressed air of sufficient quantity that will dislodge sediment or dirt.
  - 2. Remove flow indicating and flow measuring devices before flushing. Replace after cleaning is completed.
- C. Initial Pressure Test:
  - 1. Install service outlets.
  - 2. Pressurize to one and one-half times design pressure or 150 psig, whichever is greater, with dry oil-free compressed air.
  - 3. Test for leaks using soapy water or other equally effective means.
  - 4. Repair leaks.
- D. Standing Pressure Test:
  - 1. Completely assemble outlets and all other components.
  - 2. Test system at 20 percent above design pressure or 66 psig, whichever is greater, with dry oil-free compressed air.
  - 3. Hold test for 24 hours with source shut-off valve closed. Temperature fluctuations must be considered. C/M and O/R will inspect joints.
- E. Repair of Leaks:
  - 1. Mechanical or Threaded Joints:
    - a. Tighten joints using discretion, or
    - b. Take joint apart and replace defective material.
  - 2. Soldered Joints: Take joint apart, clean both tube and fitting, and remake joint.
  - 3. Welded Joints:
    - a. Remove defective weld metal by chipping, grinding or flame gouging. Reweld following new work procedure in accordance with ASME B31.3.
    - b. Do not repair by adding weld metal to defective area.
  - 4. Plastic Joints: Take joint apart and replace with new material.
  - 5. Brazed Joints: Defecting joints shall be repaired only as allowed by NFPA 99, otherwise cut out and replace joint or fitting.

6. Retest after repairs.

SCHEDULE P-8.14

A. Applies to Schedules: P-4.6.

B. Flushing:

1. Flush internals of system with domestic water of sufficient velocity and quantity that will dislodge sediment or dirt.
2. Isolate and/or bypass all equipment in systems which are not being tested or are not capable of withstanding the pressure test. Do not use system pumps.
3. Fill system with domestic water, flush internals of system for thirty minutes. Then drain system, including low points.

C. Testing:

1. Fill system with domestic water. Pressure test at 150 psi for 2 hours, during which, pressure shall remain constant without pumping. If leaks or defects develop, disassemble and re-make joints and re-test.

D. Detergent Cleaning:

1. Only after completing successful pressure testing proceed to clean the system.
2. Install weld sample coupons in piping system at a remote location from solution tank to verify cleaning and passivation procedure.
3. Use domestic or deionized water with a minimum specific resistance of 10 megohm-cm at 25 degrees C (77 degrees F).
4. Provide portable cleaning solution storage tank(s), heat exchanger(s), and pumping system(s) required for detergent cleaning and passivation.
5. Connect cleaning solution tank and pump to system. Pump shall be capable of delivering solution at velocity not less than five feet per second through all piping and equipment.

6. Procedure:

a. Pump a 2 percent by volume sodium hypochlorite and water mixture throughout system at a temperature between 140 - 160 degrees F.

b. Proceed upstream from point of chlorine application, opening all taps until chlorine is detected. Close taps when chlorine is evident.

c. When chlorinated water has been brought to every tap, retain water in system at least 1 hour.

d. At end of retention period, drain system into retention tank and neutralize to a pH range between 6 to 9 prior to discharge

into sewer system. Fill solution tank with domestic or deionized water and fill system. Open all faucets and taps, and thoroughly flush with clean water until chlorine residual is less than 1.0 ppm.

E. Passivation:

1. Use domestic or deionized water with a minimum specific resistance of 10 megohm-cm at 25 degrees C (77 degrees F).
2. With cleaning solution tank and pump still connected to system prepare solution for passivation.
3. Procedure:
  - a. Pump a 10-15 percent by volume citric acid and water mixture throughout system at a temperature between 140 - 160 degrees F.
  - b. Proceed upstream from point of solution application, opening all taps until acid solution is detected using pH paper. Close taps when solution is evident.
  - c. When solution has been brought to every tap, retain solution in system at least 3 hours. Monitor temperature and concentration at tank and maintain within range.
  - d. At end of retention period, drain system into retention tank and neutralize to a pH range between 6 to 9 prior to discharge into sewer system. Fill solution tank with domestic or deionized water and fill system. Open all faucets and taps, and thoroughly flush with clean water until pH range is roughly equal (plus or minus 0.1 pH units) to the source water.
4. Remove weld sample coupons from piping system and test in accordance with ASTM A380/A380M to verify passivation.

F. Repair of Leaks:

1. Mechanical or Threaded Joints:
  - a. Tighten joints using discretion; or
  - b. Take joint apart and replace defective material.
2. Welded Joints:
  - a. Remove defective weld metal by chipping, grinding or flame gouging. Re-weld following new work procedure in accordance with ASME B31.3.
  - b. Do not repair by adding weld metal to defective area.
3. Retest after repairs.

SCHEDULE P-8.15

- A. Applies to Schedule: P-6.2.
- B. Cleaning: After installation blow system clear with dry, oil-free compressed air.
- C. Pressure Test:
  - 1. Inspect entire length of conduit runs prior to applying any pressure. Visually and physically check each fitting to ensure joints have been cemented. If any joint is not cemented complete joint and allow to fully cure before pressure testing. Refer to manufacturers recommendations for time to cure based upon temperature and humidity. At NO time is it to be less than 2 hours.
  - 2. Plug ends of conduit and close pull boxes.
  - 3. Test system at 2 psi pressure with dry, oil-free compressed air.
  - 4. Hold test pressure for 15 minutes with source gas shut-off valve closed. Temperature fluctuations must be considered.
  - 5. Using soap and water mixture check each joint.
  - 6. If bubbles form repair leak as described below.
- D. Repair of Leaks:
  - 1. Joints: Cut away fitting and using new couplings and fittings, splice in new fitting. Clean both tube and fitting, and make joint.
  - 2. Retest after repairs.

SCHEDULE P-8.16

A. Applies to Schedule: P-4.4, P4.8, P-6.2, P-6.3.

B. Flushing:

1. Provide pre-filter, carbon filter and exchangeable mixed bed deionizer(s) in order to produce required deionized water. Provide a 0.45 micron filter downstream of deionizer(s).
2. Deionized water shall have a minimum specific resistance of 1 megohm-cm at 25 degrees C.
3. Isolate and/or bypass all equipment in system.
4. Do not use system pumps.
5. Fill system with deionized water, circulate water with a minimal return quality of 1 megohm-cm at 25 degrees C for eight hours with UV light and 0.45 micron filter in place, then drain the system including low points. Refill system with deionized water then bleed air from system.

C. Field Testing and Balancing:

1. Notify AE and Contracting Officer two weeks in advance of testing.
2. Pressure test piping after flushing is completed.
3. Isolate all purified water generating equipment.
4. Provide portable pumps for pressure test.
5. Pressure Test: Test with water pressure of one and a half times the working pressure, for a period of one hour, during which time pressure shall remain constant without pumping. If leaks or defects develop, disassemble and re-make joints. Pipes which will be installed in concealed locations may be pressure tested separately from other parts of the system.

6. System Operating Test and Balancing:

a. Perform system operating test and balancing under supervision of Section 22 67 00 PURIFIED WATER GENERATING EQUIPMENT.

b. Perform an operating test for the entire system for eight hours after all equipment is operating at normal capacity. Make required adjustment to piping system and equipment for proper functioning.

7. Delay balancing until system operating test has been successfully complete.
8. Provide additional valves as required to balance entire system.
9. Balance system to provide specified purified water supply to every part of the building without disruption of purified water return



flows.

10. After tests and balancing have been completed and accepted, operate system for at least five days to demonstrate satisfactory operation.

11. Submit written test reports.

D. Sanitizing:

1. Use either chemical or ozone treatment for sanitizing.

2. Chemical Treatment:

a. Perform sanitizing under supervision of Section 22 67 00 PURIFIED WATER GENERATING EQUIPMENT.

b. System shall be in an operational state of completion and filled with deionized water.

c. Isolate and/or bypass all purified water generating equipment, except for system pumps and storage tank.

d. Furnish necessary exchangeable mixed bed deionizers to provide required deionized water. Provide a 0.45 micron filter downstream of deionizers.

e. Deionized water used shall have a minimum specific resistance of 1 megohm-cm at 25 degrees C.

f. Sanitize distribution mains, branches, drops, valves and bypass legs as follows:

(1) Using system pump, circulate deionized water with 60 ppm of chlorine or sodium hypochlorite for a minimum of 60 minutes at design capacity and ambient temperature.

(2) Flush entire piping system using deionized water for a minimum of 45 minutes at design flow or until no traces of sanitizing agent are found.

(3) Refill system with purified water and make system ready for use.

g. Submit report of sanitizing.

3. Ozone Treatment:

a. Perform sanitizing under supervision of Section 22 67 00 PURIFIED WATER GENERATING EQUIPMENT.

b. System shall be in an operational state of completion and filled with deionized water.

c. Isolate and/or bypass all pre-treatment equipment, reverse osmosis, mix-bed deionizers and polishers.

d. Turn off ultra-violet sterilization units.

- e. Remove filter cartridge elements from housing.
- f. Provide exchangeable mixed bed deionizers for required deionized water. Provide a minimum of 0.45 micron filter downstream of deionizer.
- g. Deionized water used shall have a minimum specific resistance of 1 megohm-cm at 25 degrees C.
- h. Subject distribution mains, branches, drops, valves, fixtures, bypass legs, distribution pump, storage tank, UV lights and filter housings to the following cycles for sanitizing. Inject ozone into piping loop system until a level of 0.5 to 1 ppm is reached. Run each point of use tap, until that level of ozone is obtained.
  - (1) Circulate for a minimum of two hours with periodic tap testing to maintain 0.5 to 1 ppm level of ozone.
  - (2) Turn on UV lights to convert ozone to oxygen and recirculate system for a minimum of 30 minutes or until all traces of ozone are gone (zero level) including each use point outlet and/or equipment connection.
- 4. Refill system with purified water to its original operational state.
- 5. Place pre-treatment equipment including reverse osmosis and mix-bed deionizers and polishers back into service and replace all filter cartridge elements.
- 6. Draw water samples for lab testing to qualify the system.

SCHEDULE P-8.17

- A. Applies to Schedules: P-4.1.
- B. Welds: All welds shall be visually inspected by AWS or equal certified inspectors subject to Government approval. Randomly test 50 percent of welds using non-destructive examination (NDE) methods such as ultrasonic testing that are clearly documented by certified inspectors. 100 percent of those random welds shall pass or 100 percent of all welds shall be required to be NDE tested. Refer to section 40 17 26.00 WELDING PRESSURE PIPING for additional welding, examination and testing criteria.
- C. Cleaning:
  - 1. Flush internals of system with water of sufficient velocity and quantity to dislodge sediment or dirt.
  - 2. System may be tested in sections. Record information on installation and removal of blanks, plugs, or caps. Remake joints that were blanked or plugged.
- D. Hydrostatic Test:
  - 1. Remove pipe system devices not designed to withstand specified test pressure. Replace after testing is completed.
  - 2. After flushing, fill system with water, venting off entrapped air at high points of system.
  - 3. Apply hydrostatic pressure to one and one-half times design pressure or 50 psig, whichever is greater.
  - 4. Hold test pressure for 4 hours. AE, Contractor, and Government will inspect to determine whether there is a visible leak or significant pressure variation. (Temperature variations must be considered).
  - 5. When hydrostatic test is approved, drain water to sewer.
- E. Tabulate and submit test results.
- F. Repair of Leaks:
  - 1. Welded Joints:
    - a. Remove defective weld metal by chipping, grinding, or flame gouging. Reweld following new work procedure as indicated by ASME B31.1.
    - b. Do not repair by adding weld metal to defective area.
  - 2. Retest system after repairs.

SCHEDULE P-8.18

- A. Applies to Schedule: P-7.6.
  - B. Cleaning: After installation blow system clear with dry, oil-free compressed air.
  - C. Pressure Test:
    - 1. Inspect entire length of runs prior to applying any pressure. Visually and physically check each fitting to ensure joints have been cemented. If any joint is not cemented complete joint and allow to fully cure before pressure testing. Refer to manufacturers recommendations for time to cure based upon temperature and humidity. At NO time is it to be less than 2 hours.
    - 2. Plug ends of piping.
    - 3. Test system at 5 psi pressure with dry, oil-free compressed air.
    - 4. Hold test pressure for 15 minutes with source gas shut-off valve closed. Temperature fluctuations must be considered.
    - 5. Using soap and water mixture check each joint.
    - 6. If bubbles form repair leak as described below.
  - D. Repair of Leaks:
    - 1. Joints: Cut away fitting and using new couplings and fittings, splice in new fitting. Clean both pipe and fitting, and make joint.
    - 2. Retest after repairs.
- End of Section --

PASSIVATION LOG SHEET  
(FIGURE 3)

DATE \_\_\_\_\_ OPERATOR \_\_\_\_\_ SUPERVISOR \_\_\_\_\_

BLDG \_\_\_\_\_ FLOORS \_\_\_\_\_ AREA(S) \_\_\_\_\_

CAUTION SECTION: READ \_\_\_\_\_

I. ALKALINE RINSE (1%)

Alkali Used \_\_\_\_\_ Water Quality \_\_\_\_\_

Volume of Alkali \_\_\_\_\_ Volume \_\_\_\_\_ of \_\_\_\_\_ Water

Volume of 1% Solution \_\_\_\_\_ Temperature \_\_\_\_\_

Recycle Start \_\_\_\_\_ Recycle Finish \_\_\_\_\_

Total Time \_\_\_\_\_

II. DI/RO/DRO Water Rinse:

Recycle Start \_\_\_\_\_ Recycle Finish \_\_\_\_\_

Total Time \_\_\_\_\_

Remarks \_\_\_\_\_

III. ACID RINSE (10%)

Acid Used \_\_\_\_\_ Water Quality \_\_\_\_\_

Volume of Acid \_\_\_\_\_ Volume \_\_\_\_\_ of \_\_\_\_\_ Water

Volume of % Acid Solution \_\_\_\_\_

Temperature \_\_\_\_\_

Recycle Start \_\_\_\_\_

Recycle Finish \_\_\_\_\_

Total Time \_\_\_\_\_

IV. WATER RINSE:

Recycle Start \_\_\_\_\_ pH of Rinse \_\_\_\_\_

Recycle Finish \_\_\_\_\_

SECTION 22 72 00.01

EFFLUENT DECONTAMINATION SYSTEM

06/22

PART 1 GENERAL

**NOTE:** Some specification sections referenced are not a part of this issue. The Design Build Contractor (DBC) shall include these specifications during the next phase of the project.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX

BPVC Section IX-Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A108

Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A123/A123M

Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A269/A269M

Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A270/A270M

Standard Specification for Seamless and Welded Austenitic and Ferritic/Austenitic Stainless Steel Sanitary Tubing

ASTM A789

Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing For General Service.

ASTM A36/A36M

Standard Specification for Carbon Structural Steel

ASTM A380

Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

ASTM A572/A572M

Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M

Structural Welding Code - Steel

## 1.2 RELATED DOCUMENTS

Section D20 - PLUMBING and Section D30 - HVAC apply to this section. Plumbing Sections 22 10 05 and 22 10 06.

Electrical Sections 26 00 00, 26 20 00, 26 29 23.

Refer to Section 22 72 00.01 Effluent Decontamination System Datasheet for performance based sizing criteria and system requirements located in Chapter 6, section C10 of this RFP.

Refer to Overall Effluent Decontamination System Flow diagram (PFD100) in Appendix G for a conceptual diagram showing the major equipment, components, and instruments.

Refer to Architectural drawing A105 for a conceptual layout.

Refer to Section 40 17 26.00 WELDING PRESSURE PIPING for welding requirements.

## 1.3 SUMMARY

Section includes:

- a. Storage Tanks (ST).
- b. Solids Reduction/Recirculation pumps.
- c. Filtration Units.
- d. Effluent Decontamination System (EDS) supply Pumps.
- e. EDS Tube skid.
- f. Heat Transfer system.
- g. CIP System.
- h. Effluent Instrumentation and Control System.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

#### EDS Vendor Experience; G

The EDS Vendor shall provide experience record listing a minimum of 3 projects in which they have provided similar equipment as specified herein; G

Submit quality assurance information; G

The EDS Vendor shall provide biological efficacy testing data of existing systems provided by vendor similar to equipment as specified herein. Data shall contain biological verification and temperature/pressure and time logs of treatment cycles; G

Utility Coordination; G

Submit a coordination document listing all utility connections required for system operation. Information may be in spreadsheet format, and shall at a minimum identify the size of service, service load, and to what piece of equipment the service is intended for. Utility information not provided but deemed necessary during construction will be provided at no cost to the government. Refer to the 22 72 00.01 datasheet for a listing of available utilities with flow rates and pressure.

Risk Analysis; G

Risk Analysis shall include the following three Items for the supplied systems within the EDS vendor's scope:

- (1) PHA Process Hazard Analysis
- (2) HazOp (Hazard Operations Analysis)
- (3) FMEA Failure Mode Effect Analysis and reliability of all components.

The successful EDS vendor shall design the entire system in 3D and shall provide the 3D model to the design build contractor in multiple stages during the project. The first deliverable (30% completion) shall include the major equipment skid volume sizes so that it can be included in the building 3D model. Maintenance envelope access requirements shall be included. The second deliverable shall be at 60% to 70% completion where the orientation of the individual skids and components can be reviewed for adequate maintenance and serviceability access. Maintenance envelope access requirements shall be included. The final deliverable shall include all the skids with internal components and the interconnecting piping at the project completion; G

#### SD-02 Shop Drawings

Submit information that illustrates completely the entire system and its intended operation. Submittal may be broken into separate submittals in the following order:

P&ID; G

Provide complete P&ID drawing showing all equipment, components, valves, instruments, control points and incoming service requirements within the system. Drawing shall include a delineation of EDS vendor scope and customer supplied scope. Interconnecting piping provided by the EDS vendor shall be shown on the P&ID and labeled as field installed piping by the EDS vendor.

Mechanical Fabrication Drawings; G

Submit large scale drawings that illustrate completely the proposed construction of each skid and components provided by the



## Repair Steam Sterilization Plant (SSP)

EDS vendor.

The drawings shall include complete dimensional and other information regarding materials, finishes, gauges, fasteners, and other pertinent information necessary for evaluation of the proposal.

Electrical Fabrication Drawings; G

Submit large scale drawings that illustrate complete assembly of each electrical cabinet, and interconnecting wiring.

Sequence of Operations; G

Submit complete I/O list and sequence of operation in algorithm form which follows PLC logic to be programmed.

### SD-03 Product Data

Provide cover sheet(s) indicating each product with a designation which corresponds to the P&ID drawings, and the corresponding manufacturer and model number. Example columns indicated below:

Submit catalogue or other information identifying components and relevant performance characteristics of the following:

Actuators Control Valves; G  
Desktop Computers Electrical Panels; G  
Flow transmitters; G  
Heat Transfer System; G  
HEPA Vent Filters; G  
Insulation; G  
Isolation Valves; G  
Leak Detection; G  
Level Transmitter; G  
Level Sensors; G  
Pipe and Pipe Fittings; G  
Pressure Transmitters; G  
Pressure Gauges; G  
Pressure Reducing valves; G  
Pressure Relief Devices; G  
Pumps; G  
Storage Tanks; G  
Steam Traps; G  
Temperature Transmitters; G  
Tube Skid; G

### SD-05 Design Data

Submit performance data for Storage Tanks, Relief Vent system, HEPA Vent Filters, Pumps Skids, Filtration Units, Tube and Tube Heat Exchangers and CIP systems; G

Submit pressure loss calculations for piping systems.

### SD-06 Test Reports

Submit test procedures for approval prior to performing tests; G

Factory Acceptance Test; G

Submit test data indicating all electrical and pneumatic components operated successfully in a dry simulation. Refer to Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING for EDS commissioning requirements. Refer to Narrative, Chapter 6, Section H10 for additional FAT requirements.

Point to Point Verification; G

Submit test data indicating complete wiring check after installation; G

Start-up Test; G

Submit test data indicating all components operated per the design requirements identified in this specification. Identify any deviations and accepted corrections.

HEPA Vent Filter Validation; G

Submit test data of installed integrity testing of HEPA Vent filters.

#### SD-07 Certificates

Submit certificate to verify passivation of equipment and piping; G

Submit Welders certifications for each welder; G

Submit welding procedures verification; G

Instrument Calibration Certificates; G

#### SD-08 Manufacturer's Instructions

Submit Installation Instructions; G

Submit Pre-Start Check-list; G

Submit Training Outline; G

#### SD-10 Operation and Maintenance Data

Submit information for Operation and Maintenance Manuals prior to system start up; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Data shall contain information required for maintenance and repair and shall contain no evidence that proprietary maintenance arrangements with the manufacturer will be necessary. Equipment which will require proprietary maintenance arrangement with the manufacturer require Government review and approval.

Vendor shall supply a recommended spare parts list. G

## 1.5 QUALITY CONTROL

### 1.5.1 Welding

Welding materials shall conform to ASME BPVC SEC IX. Welding Materials and Procedures. Follow Section 40 17 26.00 WELDING PRESSURE PIPING.

### 1.5.2 Welders

Certified in accordance with ASME BPVC SEC IX and AWS D1.1/D1.1M.

### 1.5.3 Start-Up and Installation Engineer

The design build contractor (DBC) shall assign a quality control manager (QCM) to lead and coordinate project quality control and work with the third party commissioning authority.

Provide the services of a vendor employed qualified engineer or technician for start-up tests and installation of equipment as specified. More than one engineer or technician may be employed based on the types of specific equipment.

Submit a printed certified qualification resume of the engineer or technician. The engineer's or technician's resume shall list applicable experience related to installation, start-up, and testing of equipment and applicable factory training and education. Qualifications require the engineer to have supervised a minimum of three (3) installations of individual skid processing size of 10 gpm or larger. The EDS system experience shall be a continuous system that is operating satisfactorily. If more than one engineer or technician is employed, provide a certified resume for each one indicating their specific specialty and item of work.

After installation of equipment, the engineer or technician shall submit a signed certificate or certified written statement that the equipment is installed in accordance with the manufacturer's recommendations.

Refer to Section 01 91 00.15 10 - TOTAL BUILDING COMMISSIONING for additional information.

## 1.6 EQUIPMENT WARRANTY AND REMEDY

The EDS Vendor shall warrant to the Customer that equipment of Vendor is free from manufacturing defects for one (1) year from the Beneficial Occupancy Date (BOD).

- a. The EDS Vendor guarantees to either repair or replace parts found to be defective, provided written notice of the alleged defect is provided within one (1) year from date of site acceptance.
- b. The warranty is not intended to include:
  - (1) Ordinary wear and tear, erosion, corrosion.
  - (2) Unintended use, misuse, abuse or improper handling, operation or storage by any third party.
  - (3) Inability of the EDS Vendor or its subcontractors to make timely delivery on account of Acts of God, labor troubles, intervention or any civil or military authority, material shortages, delays by suppliers or any other cause reasonably beyond its control.

- c. The EDS vendor shall provide and optional breakout price for a warranty duration of 3 years from the date of completion and approval/sign off of the project site acceptance test.

#### 1.7 COMMISSIONING

- a. Equipment and systems specified in this section shall be commissioned in accordance with the Contract Documents.
- b. Refer to Division 1 for commission requirements. Also refer to Chapter 6 H10 of this RFP for commissioning scope related to the EDS system.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

Vendor Experience: Vendors shall submit a list of actively running BSL3/BSL4 projects and site contacts for such projects.

#### 2.2 GENERAL

Products specified herein are minimum requirements. The EDS Vendor is responsible for providing all components necessary to provide a complete and operational system.

Vendor shall ensure design is safe, and all necessary isolation valves or other safety devices are in place to enable safe shut/down and/or maintenance of the system without exposure of untreated effluent to the users or the environment. Vendor shall provide recommended spare parts list which shall include device, lead time, shelf life, and current price.

The spare parts list shall be divided into to two sections, the first section are spare parts which will require decontamination in addition to lock out tag out procedures prior to performing maintenance. The second spare parts list shall include components that do not require decontamination prior to maintenance activities.

If the EDS vendor takes exception to any portion of the specification they shall indicate in writing why the exception is taken and how it will improve the design.

#### 2.3 SYSTEM DESCRIPTION

The EDS Vendor shall engineer and fabricate a modular Effluent Decontamination System (EDS). System shall consist of 4 storage tanks, 2 solids reduction pumps, 3 filtration units, 4 EDS supply pumps, heat recovery system, 3 EDS tube skids, 2 CIP skids, associated automated and manual valves, instrumentation, PLC, desktop computers, printer, and any components necessary to provide a complete and operational system.

##### 2.3.1 Engineering and Services by EDS Vendor

- a. The EDS Vendor shall provide engineering and services as required to provide a fully engineered, operational system, assuming all field wiring, and utilities are provided per the vendor's requirements. Engineering and services shall include, as a minimum the following activities:

- (1) Generate a Process and Instrumentation Diagram (PID) of the entire Effluent Decontamination System (EDS) showing all valves, instruments and component and how they are controlled.
- (2) Sizing and design of all components, based on the operational conditions specified.
- (3) Provide detailed sequence of operations of all EDS functions. Sequences shall include the operation descriptions using the valve, component and instrument numbers established on the PID.
- (4) Design of all piping and other accessories within the skid boundaries. This shall include pressure loss calculations. Drawings shall be created for all piping systems, complete with piping and valve sizes, pipe and valve numbers, and dimensional information.
- (5) Design and documentation of all interconnecting piping, components, and accessories between the EDS vendor skids.
- (6) Generate a 3D BIM model so that the arrangement of all piping and equipment on all skids can be reviewed for proper equipment access. The 3D models shall show the minimum clearances and space required for maintenance of equipment and instruments.
- (7) Creation of general arrangement and structural load diagram drawings. General arrangement drawings shall show plan and elevation views of the supplied equipment as it will be located in the Customer's facility.
- (8) Creation of valve list and instrument data sheets. The valve list and instruments shall have a unique number that matches the PID provided by the EDS vendor.
- (9) Creation of preliminary and final I/O list.
- (10) Assembly of a complete erection package, including the necessary requirements and specifications for field piping, wiring and insulation, as well as for installing the tanks and equipment.
- (11) Design of all wiring systems and supply of wiring interconnecting diagrams, schematics, and loop diagrams for all electrical equipment. All wiring shall be color coded and/or labeled.
- (12) Vendor is responsible for providing the correct specifications for materials of construction, relevant operating conditions including noise requirements and warranty requirements to all sub-vendors for all material and equipment purchased by Vendor.
- (13) The EDS vendor can offer alternate material of construction if the specified MOC is not deemed sufficient for the stated waste and decontamination fluids indicated in the datasheets. The EDS vendor shall provide data backing up their recommended materials of construction.
- (14) The EDS vendor shall evaluate the redundancies, including pipe routing, provided on this RFP by providing a Risk Assessment and reliability analysis of the entire system. The analysis may determine that additional redundancies are required, but

redundancies shall not be less stringent than indicated elsewhere in this RFP unless otherwise accepted by the owner. The owner shall approve the analysis. Refer to Section 01 45 00.00 10 Article 3.8 for additional requirements.

- (15) The EDS manufacturer and the DB Design and Construction team shall meet all requirements of Section governing sections of the specification in Division 01, including but not limited to Sections 01 45 00.00 10 on Quality (including paragraph 3.8 on Risk Assessments), Section 01 33 16.00 10 which includes requirements on BIM, modeling and evaluation of design detailing on maintenance and equipment replacement of components, and Section 01 33 16.00 10 defining required steps and actions during the detailed design and fabrication process. Coordinate a detailed risk assessment during the detailed design phase of the project with the owner and Design Build contractor. The systems specified herein and on the EDS Overall flow diagram (PFD-100) are primary containment only. The project team shall provide secondary containment consistent with BSL4 organisms handled.
- (16) The EDS vendor shall coordinate the equipment layout with the design build contractor. The EDS vendor will be responsible to ensure that the layout works with the existing building structure. The coordinated layout includes but not limited to the determination of the stack up of the gravity piping from the storage tank outlet to the filtration units and then to the Biowaste feed pumps.
- (17) The EDS vendor shall coordinate with the design build contractor that the designed skids sizes can be routed into the building and into its final position.
- (18) All building trades and the DBC shall coordinate with the EDS vendor providing pipe loads imparted from the facility to the EDS. This includes the steam and condensate piping loads that generated due to the expansion and contraction of the piping. A final certification of a code compliant finite element and thermal stress analysis shall be provided by the DB and the EDS vendor.

#### 2.4 EFFLUENT STORAGE TANKS

Vendor shall provide 4 effluent storage tanks each consisting of the following:

- a. Unless specified otherwise, all components shall be of 316L - minimum 10 gage stainless steel construction. Final thickness of tank shall be determined based on the required pressure and vacuum rating.
- b. Each tank shall have a 25,000 gallon capacity (Excludes volume for level sensors in top head space). Each tank shall be rated at 45 psig and full vacuum and ASME stamped and field ASME certified. Tank shall be field erected.
- c. Each tank shall be of a cylindrical design mounted horizontally with elliptical heads.
- d. Tank shall be externally stiffened, if required, to withstand all imposed loads.

The internal wetted surfaces of all process vessels and piping containing bio-matter shall be passivized at the site after field fabrication to insure enhanced corrosion resistance. Refer to ASTM A380 Standard Practice for Passivation of Stainless Steel. The cleaning/passivation process shall remove greases, oils, coolants and exogenous iron or iron compounds from the surface of the stainless steel by means of a chemical dissolution using an environmentally friendly detergent and citric acid method. The use of nitric acid is specifically not allowed due to health, safety and environmental reasons. All surface discoloration due to welding shall be mechanically removed prior to passivation. Tanks will be welded together and passivated on site.

e. As a minimum, each storage tank shall have the following ports:

- (1) Inlet with dual isolation valves for BSL3 and BSL4 gravity Biowaste. Refer to Paragraph 2.10 "Valves and Accessories" for valve requirements.
- (2) Provide decontamination ports with isolation valves to enable decontamination of the entire biowaste system, including piping. All decontamination paths shall include an isolation valve
- (3) Storage tanks shall have breather vent with flange connection and isolation valves for decontamination of vent filters.
- (4) 24 inch manway for access in the tank.
- (5) Four (4) 4 inch spare ports complete with flange and blank off plate located at the top of the tank.
- (6) Port sized to accommodate Ultrasonic Radar level transmitter.
- (7) Multiple level detection ports, low level, EDS system 1 energize, EDS system 2 energize, high level and High High level.
- (8) Recirculation port from EDS tube skid discharge outlet.
- (9) Recirculation port for re-circulation of waste from solids reduction pumps with a non-fouling eductor and flow multiplier at the opposite end of the tank from the pump suction to maximize flow across the tank.
- (10) Steam inlet port/s for tank decontamination.
- (11) Steam condensate drain port/s from steam Decontamination.
- (12) Steam Condensate inlet port/s for receiving steam condensate from tank that is undergoing a decontamination cycle.
- (13) Non-Potable water port for introduction of water for flushing.
- (14) Compressed air port for air flushing of the tank for the Decontamination cycle.
- (15) All connections to the tanks that require servicing shall not be welded.
- (16) All utilities connecting to tanks shall be provided with an isolation valve. Ensure that valves are positioned to enable the

tank to be removed.

Refer to the 22 72 00.01 datasheet for additional storage tank requirements. If there is a discrepancy the more stringent requirement shall apply.

## 2.5 RECIRCULATION/SOLIDS REDUCTION PUMPS

The re-circulation pump shall continuously run so that solids are constantly being reduced and waste is flushed from the back of the tank to the front. Refer to the datasheet for design requirements.

## 2.6 FILTRATION UNITS

There shall be three filtration units provided in the scope of the EDS. One filtration unit will operate at a time while the other unit is either on standby or in the Decontamination mode. The online filter will separate any particulates larger than the size indicated on the datasheet. The excess loading of the filter will be determined based on an increase in pressure drop, reduction in flow and/or based on a period of time determined by the field operational data. When a filter is offline due to required cleaning an automated Decontamination cycle shall be performed prior to opening of the filter. After the decontamination cycle is successfully performed and all decontaminated solids are removed then the filtration unit is ready to be placed on stand-by again. Refer to the datasheet for the design requirements.

## 2.7 EDS TUBE SKID AND ENERGY RECOVERY HEAT EXCHANGERS

Two tube in tube energy recovery heat exchangers shall be provided to first preheat the fluid prior to reaching the inactivation temperature and second to cool the out flowing waste from the EDS tube skid system. Provide additional heat exchangers in the EDS Tube skid to raise the temperature of the waste to the required decontamination temperature and to hold the temperature above the required decontamination temperature. Both heating exchangers will use steam as the heat transfer medium. The EDS vendor shall provide pressure reducing valves to regulate the customer supplied steam to the required pressure. The EDS vendor shall provide steam powered pump traps for the condensate handling from the EDS tube skid to the customer's condensate collection system.

## 2.8 EFFLUENT DECONTAMINATION COOLING SYSTEM

Provide tube in tube heat recovery heat exchangers and water circulation system to recover heat to and from the retention tube heat exchanger. A dedicated heat transfer fluid loop shall circulate within the outer portion of the tube and tube exchangers. Provide pumps, expansion tank, automatic fill connection, and all components necessary for a complete heat transfer system. The heat transfer system pressure shall be higher than the effluent waste flowing in the inner tube to ensure if there is a leak in the heat exchanger it will be from the transfer fluid into the effluent waste thus not contaminating the heat transfer fluid loop. Refer to the datasheet and PFD-100 in the Appendix for required energy recovery from the economizers and a schematic of the heat transfer system.

Provide a non-potable water sparging system as a back-up to cool the waste below 60 degrees C if the heat transfer system malfunctions.



## 2.9 HEPA VENT FILTERS

A duplex filter assembly (two filters in series and two in parallel) shall be provided by the EDS vendor for installation for the storage tank vent.

- a. Acceptable Manufacturers: Pall, Millipore.
- b. Filter cartridge shall be constructed of a PTFE membrane with absolute efficiency at 0.2 microns.
- c. Filter housing shall be constructed of 316L stainless steel. Housing shall have integral test and/or decontamination ports complete with isolation valves. Housing shall be free of burrs and sharp edges.
- d. Provide electric trace heater, silicone jacket with temperature sensor and temperature control unit. Where filters are provided in series, heater shall be provided on both housings.
- e. Provide flanged connections airtight silicon seal capable of withstanding 45 psi steam temperatures and pressures.
- f. Filter, housing, appropriate isolation valves, and ports shall provide means of chemical and steam decontamination and filter efficiency testing in place. Manufacturer shall provide testing procedure for in place testing.
- g. Refer to the 22 72 00.01 datasheet for sizing criteria.
- h. The vent filter shall be designed in accordance to BMBL guidelines and shall include an automatic steam Decontamination cycle. The condensate from the Decontamination cycle shall drain into the Storage tank.

## 2.10 VALVES AND ACCESSORIES

### 2.10.1 Biowaste Piping

#### 2.10.1.1 General

The EDS vendor shall provide all piping within each skid boundary and the interconnection piping between the EDS skids.

Materials from storage tank drain valve to filtration units, to EDS system and building drain connection:

- a. Pipe: Stainless Steel, ASTM A312, seamless, 316L, Schedule 40 passivated or 316L SS tubing, ASTM A269/A269M and ASTM A270/A270M, passivated.
- b. Joints: Orbital Welded, ground smooth.
- c. Fittings: Flanged or high pressure bolted tri-clamp.

Materials biowaste header to storage tanks:

- a. Biowaste drainage piping to the storage tank will be provided by the Design Build Contractor.
- b. Pipe and Pipe Fittings: 316L stainless steel. Refer to the plumbing

section.

Materials within the EDS tube skid:

- a. Alloy 2205, or approved equal. ASTM A789.

#### 2.10.2 Manual Isolation Valves (Steel and Stainless Steel Service Piping)

- a. Acceptable product: 316L SS Three-Piece ball valves for 6 inches and smaller. Provide alternate quote for Butterfly valves for 6 inches and larger. Valve shall be rated for temperatures up to 400 degrees F at 150 psig. All valves in contact with Biowaste shall be sanitary/hygenic and capable of being decontaminated in place.
- b. Isolation valves shall be fully ported positive shut off quarter turn ball valve with tamper-proof lockable handle.
- c. Seats, packing and seals shall be modified PTFE to meet the temperature requirements.
- d. Valve materials shall be either carbon steel or stainless steel, to match the pipe material in which the valve is installed.
- e. Ball material shall be ASTM A108 chrome plated for carbon steel service.
- f. API 608 compliant for ball valve sizes greater than 3 inches.
- g. Valves shall be rated for less than 10% failure after 100,000 cycles.
- h. Provide ball valve with filled casings.

#### 2.10.3 Automated Block (2-position) Valves

- a. Automated valves shall be ball valves as specified for manual isolation.
- b. Automatic valves shall use pneumatic actuators with solenoids.
- c. Automatic valves shall be provided with limit switches and local indicators to indicate valve open/closed status.
- d. For all automated valves of all utilities and the Biowaste piping with the EDS system from storage to discharge, provide hand operable valves in addition to automatic controllers.

#### 2.10.4 Modulating Valves

Modulating valves shall be characterized ball valves.

- a. Seats, packing and seals shall be modified PTFE to meet the temperature requirements.
- b. Valve materials shall be either carbon steel or stainless steel, to match the pipe material in which the valve is installed.
- c. Ball material shall be ASTM A108 chrome plated for carbon steel service.

## Repair Steam Sterilization Plant (SSP)

- d. Valves shall be rated for less than 10% failure after 100,000 cycles.
- e. Provide modulating valve with filled casing.

All modulating valves shall be provided with position indicators to indicate valve status.

### 2.10.5 Relief Valves

Relief valves and or Rupture discs shall be stainless steel construction. Seats shall be PTFE. Seals shall be PTFE.

The high temperature Biowaste piping shall be protected by a rupture disk followed by a back pressure valve. (To minimize release as pressure drops after a disk failure) The relief shall be routed to a phase separator/liquid capture tank which shall be vented. The purpose of this requirement is to maintain containment of waste if discharged from a safety device.

### 2.10.6 Access Platforms

(Not required at this time, but requirements to be verified during the design build phase of the project. The DBC shall demonstrate, through BIM serviceability reviews, that all serviceable components shall be accessible from the ground, with a two person scissors lift, or a single person arm bucket.

- a. Vendor shall supply all ladder, stairs, grating, handrail, stringers, kickplates, and other miscellaneous steel as required to create an access to instrument/components requiring maintenance.
- b. All steel shall conform to ASTM A36/A36M or ASTM A572/A572M Grade 50 unless otherwise noted and shall be hot dipped galvanized, after fabrication.
- c. Kickplates shall be 4 inches x 1/4 inch.
- d. Handrails shall be of the two rail variety. Handrail and post pipe shall be 1-1/2 inch schedule 40 A53.
- e. The floor of the stairs and platforms shall consist of grating shall be 1-1/4 inches x 3/16 inch bar grating.
- f. Minimum walkway width, stairway width, and access to equipment shall be as per OSHA. In no case shall any walkway width be less than 30 inches.
- g. Access shall be structurally designed for a 150 psf live load.

### 2.10.7 Other Steel

Vendor shall provide support structures, tank saddles, lifting lugs, and all other miscellaneous steel required to facilitate the installation of the vendor's product.

### 2.10.8 Insulation and Lagging

All hot components (greater than 140 degrees F) and piping shall be completely insulated with a minimum of 2 inch chloride free, rigid closed

cell insulation, minimum nominal density of 3 lb/ft<sup>3</sup> with thermal conductivity of not more than 0.23 at 75 degrees F mean temperature. Minimum compressive strength at 10% deformation shall be 25 lb/ft<sup>2</sup>. Insulation shall be fully protected with an embossed aluminum or type 304 stainless steel jacket, minimum 0.016 inch thick.

All exterior attached valves and components in hot piping systems shall have removable blanket insulation covers complete with a silicone impregnated fiberglass cloth cover, double stitched, and Velcro straps.

Vendor shall supply and install field insulation and lagging for all piping and equipment provided as follows:

- a. Drain Piping.
- b. All heating piping and valves.
- c. Any equipment or piping not identified that requires insulation for personnel protection purposes.
- d. Asbestos in any form shall not be allowed.
- e. All siding, lagging, panels, flashing, supports and fasteners are to be designed to allow for the thermal expansion present. Expansion shall not cause uninsulated gaps. The outer covering of the insulation shall not buckle during heating or cooling.
- f. All materials shall be new, clean, and dry. All materials shall be non-corroding. Insulation shall be chloride free.
- g. Caulking shall be silicone sealant or approved equal.
- h. All insulation materials shall be suitable for the maximum hot surface temperatures encountered.
- i. The insulation and lagging system shall be designed to withstand normal maintenance without incurring damage.
- j. Surfaces shall be thoroughly cleaned of loose scale, dirt, or other foreign material by use of wire brushes, scrapers, or other devices required to accomplish the work.
- k. Insulation and lagging shall be installed to fit tightly at all seams and joints. Insulation shall be contoured to fit tightly around all equipment irregularities.

Equipment name or data plates, located such that they are raised above the insulated surface, shall have the area under the plate insulated and be suitably flashed and caulked to prevent the entrance of moisture.

#### 2.10.9 Galvanizing

The following steel shall be shop hot dipped galvanized:

- a. Access grating, stair treads, platforms, handrails, support stands, and tank saddles.
- b. All galvanizing shall comply with OSHA Standards.

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- c. All galvanized steel shall have surface preparations conforming to SSPC-SP8 prior to galvanization. Cleaned surfaces shall be coated with flux until being galvanized.
- d. All steel to be galvanized shall be galvanized with a minimum coat of 0.61kg/sq meter per the latest version of ASTM A123/A123M. This includes all other ASTM codes referenced in Section 2 of ASTM A123/A123M. Warpage shall be minimized wherever possible.
- e. Steel to be field welded shall have the galvanization removed from the area to be welded. The non-galvanized area shall be a 50mm wide strip, will be COLD galvanized using Carboline (Subox Division) Galvanox or equal in the field by the installation contractor. Cold galvanization materials shall be supplied by Vendor for installer's use.

### 2.10.10 Painting

- a. Vendor shall provide all labor, supervision, materials and equipment required to shop paint the supplied equipment as specified herein.
- b. All exterior, uninsulated, ungalvanized steel shall be painted, including, but not limited to, the following major components:
  - (1) Permanent mounting brackets, lugs and other miscellaneous permanent exposed steel.
  - (2) Exposed carbon steel piping.
- c. Application of touch-up paint is by installation contractor. Vendor shall supply suitable touch-up paint materials for installation Contractor's use.
- d. Paint shall be suitable for exposure to mild chemicals.

### 2.11 ELECTRICAL

- a. Power to each piece of equipment shall be provided by the facility to a single point of connection. The Manufacturer shall provide a lockable stainless steel NEMA 4X disconnect for this connection point.
- b. The Manufacturer shall warrant that all wiring and electrical components shall comply with the NEC, as well as all applicable local electrical codes. All wiring and components shall be rated appropriately and suitable for the environment in which the equipment is installed.
- c. All wire colors shall be per UL standards. No more than two wires shall be connected to a single terminal connection. Each wire end connected to a terminal strip is identified with an individual number

### 2.12 EFFLUENT DECONTAMINATION SYSTEM CONTROL COMPONENTS

#### 2.12.1 Control System

Provide two operating NEMA 4X 100% redundant PLC control panels with redundant data collection servers in the EDS Mechanical control room as follows:

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- a. Panel shall be UL 508A certified and labeled.
- b. Contain all PLC hardware required to control the Effluent Decontamination System.
- c. Sized to contain all hardware required to accept all inputs and outputs to all effluent decontamination devices.
- d. Power disconnect switch with lockable handle.
- e. Necessary circuit breakers.
- f. Necessary transformers.
- g. Allen Bradley (preferred) or Siemens processor. The PLC shall be modular and shall contain the necessary input, output, analog, thermocouple and communication cards. Determine if redundant I/O cards are required in the design build phase of the project based on the FMEA results.
- h. The interface screen shall be minimum 15 inch touch screen and have a graphical description of the system, including tanks, piping, valves, etc. The interface will also show the operator run times, temperatures, tank levels, pressures, etc. An alarm screen shall be provided to document and track system alarms.
- i. A setpoint screen shall allow viewing and changing system setpoints.
- j. The system shall incorporate a minimum of three levels of security to prevent unauthorized access.
- k. On loss of power, the PLC will shut down in an orderly manner, all I/O to their predictable state. When power is restored, the CPU will automatically restart and resume the cycle it was in prior to power loss.
- l. The PLC shall be capable of providing a graph of Temperature, waste Flow rate, waste Retention time vs Time for the continuous treatment process. Store information in an accessible database for up to 3 years. Each graph shall be accessible from the PC interface screen via a time and date input/selection from the user. All data shall be backed up daily to a backup hard drive.
- m. Each PLC shall interface with both PC systems.
- n. All system onboard displays that provide access to the comprehensive range of adjustable parameters necessary to perform installation, adjusting, service, maintenance, and testing must provide fully compliant password protection. All external ports, USB, RS 232/485/422, that allows connection to an on-site portable laptop computer must provide the same level of fully compliant password protected access as an on-board diagnostic panel.

All systems must comply with UFC 4-010-06 Cybersecurity of Facility-Related Control Systems and UFGS 25 05 11 Cybersecurity for Facility-Related Control Systems.
- o. Redundant data servers shall be physically located in different rooms.

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Provide one work station in the EDS control room and one in the BMS control room (INA102) as follows:

- a. Minimum 500GB Hard Drive, 8GB RAM, DVD-RW, Monitor and Printer. This PC shall use software to allow for a seamless Graphic Interface and Process Trending of the entire System.
- b. Interface shall allow for complete control of the system and have access to all available data that would be accessible through the PLC.
- c. Workstation shall meet current US Government standards and must include Army Gold Standard Operating System and be hardened through application of STIGs/SRGs.

### 2.12.2 Wiring

All control and signal wiring from Vendor's equipment and instruments shall terminate at a junction box for each equipment skid.

All inter connection field wiring from control panel to all equipment specified as part of the Effluent d Decontamination System shall be provided by the vendor for installation by the installing contractor. Where more than 2 wires are required, wiring harnesses shall be clearly labelled and provided by vendor for installation by installing contractor.

All wiring from the EDS vendor PLC's to the remote work stations will be by the Design Build Contractor.

Power for control panel and skids shall be provided by installation contractor according to vendor's requirements. Vendor shall provide a single connection point for each skid for field power connection.

### 2.12.3 Control and Instrumentation Tubing

#### 2.12.3.1 Stainless Steel Tubing

ASTM A269 TP 316 L fully annealed and suitable for cold bending, RB90 hardness maximum, std. polished OD tubing.

- a. Fittings: 316L compression fittings.
- b. Isolation valves: Ball valve, fully ported 304 stainless steel.

Provide isolation valves on control air tubing to all control panels.

All tubing for each equipment skid shall be piped to one connection point with an isolation valve.

Field tubing from skid to air compressor or air pipe header shall be provided and installed by installation contractor.

### 2.12.4 Radar Level Sensors

- a. Acceptable Product: Endress and Hauser or equivalent.
- b. Non Contact 4-20mA Radar Level Sensing device with a flange mounted connection for mounting through a tank wall.
- c. Device shall maintain accuracy with an operation temperature range of

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-40 degrees F to 300 degrees F.

- d. Device accuracy shall be able to measure volume within  $\pm 1\%$  of total system volume in system being monitored.
- e. Provide level span of 0 - 100% of volume.

### 2.12.5 Point Liquid Sensor

- a. Acceptable Product: Endress and Hauser or equivalent.
- b. Tuning fork vibrating style point level switch, 316L construction, with flange mounted or NPT screw in connection.
- c. Device shall have an operation temperature range of -40 degrees F to 300 degrees F.
- d. Provide level span of 0 - 100% of volume.

### 2.12.6 Temperature Transmitters

- a. Endress and Hauser or equivalent.
- b. 4-20mA adjustable span RTD temperature transmitter, complete with visual gauge.
- c. Device shall maintain accuracy with an operation temperature range of -40 degrees F to 300 degrees F, and an operational pressure range of -14 psi to 150 psi.
- d. Device accuracy shall be  $\pm 1\%$  of calibrated span.

### 2.12.7 Pressure Transmitters

- a. Endress and Hauser or equivalent.
- b. 4-20mA adjustable span pressure transmitter, complete with visual gauge and a 20:1 turn down.
- c. Transmitter shall be protected with a 316L SS diaphragm seal.
- d. Device shall maintain accuracy with an operation temperature range of -40 degrees F to 300 degrees F, and an operational pressure range of -14 psi to 150 psi.
- e. Device accuracy shall be  $\pm 1\%$  of calibrated span, with a maximum range of 150 psi.

### 2.12.8 Pressure Switch

- a. Endress and Hauser or equivalent.
- b. SPDT snap action; single circuit, with field adjustment capability.
- c. Transmitter shall be protected with a 316L SS diaphragm seal.
- d. Device shall maintain accuracy with an operation temperature range of -40 degrees F to 300 degrees F, and an operational pressure range of -14 psi to 150 psi.



#### 2.12.9 Flow Transmitters

- a. Endress and Hauser or equivalent.
- b. Device shall have an accuracy of  $\pm 1\%$  of calibrated span. Output shall be 4 - 20 mA with a operational range of 0 - 140 gpm.

#### 2.12.10 Instrument Calibration Certificates

Calibration of control devices shall be verified no more than 6 months before project turnover. Submit calibration certificates for each control device indicating as a minimum last calibration date, and calibration or verification due date.

### 2.13 EFFLUENT DECONTAMINATION SYSTEM SEQUENCE OF OPERATION

#### 2.13.1 Storage Tanks

Each Storage Tank shall operate in cycling mode. In cycling mode, a single tank receives waste from BSL3 and/or BSL4 areas. When the storage tank becomes full, then the intake valves will close and the next storage tank will open its inlet valves. All tanks shall be headered together to and shall be isolatable from each other.

##### 2.13.1.1 Operation

- a. The storage tank drain valve will remain open unless the tank is offline.
- b. The EDS supply pump shall energize upon reaching the "EDS system unit one on level". The EDS pump will gradually ramp up and once the desired temperature (140 degrees C) is reached the EDS pump will run at the speed required to meet EDS system design capacity. When the "EDS system two on level" is reached, the energized EDS supply pump will increase the speed until the second EDS system is at the desired temperature. One EDS supply pump shall be capable of processing the waste to satisfy two EDS continuous units.
- c. One Filtration unit will be in operation at a time while the other units are either in standby or in decontamination mode. The online filter will separate any solids/particles larger than the mesh size indicate in the datasheet. The excess loading of the filter will be observed based on the rise of the waste level in the filter vessel. An automatic Decontamination steaming cycle shall be provided by the EDS vendor to ensure the waste solids are decontaminated prior to maintenance activities are performed. The automatic decontamination steaming cycle shall be manually initiated. After the automatic decontamination cycle is completed and the solids are removed the filter can be placed in the standby mode.

##### 2.13.1.2 Alarms

The EDS vendor is responsible to provide all necessary alarms for the successful operation of the system. Alarms shall both be audible and displayed on the HMI or workstation. All alarms shall require a manual verification and reset in the field. All alarm setpoints shall be field adjustable with the highest level security access.

#### 2.13.1.2.1 High Level Alarm

A general alarm shall be triggered if a storage tank reaches high level.

An alert shall be sent to personnel recommending shower-out procedures be initiated immediately.

#### 2.13.1.2.2 Overflow Alarm

A critical alarm shall be triggered if a storage tank reaches the high high level switch. The EDS PLC shall command all inlet utility valves to close preventing any additional fluids from entering the tank. Inlet Biowaste from gravity drainage that is prevented to enter the tank shall be diverted to an available tank.

#### 2.13.1.2.3 Valve Fault

If at the end of a valve actuation, the end switch does not correspond to valve position (after 1 minute delay (adj)), then a general alarm shall be generated and the valve shall fully reset and actuate again.

#### 2.13.1.2.4 Valve Failure

If at the end of a 2nd actuation in succession the end switch still does not correspond to the commanded position then a critical alarm shall be displayed at the user interface. The EDS vendor along with the design team shall determine the criticality of the valve in question and determine the course of action.

#### 2.13.1.2.5 Overpressure

If rupture disc monitor strip is broken, then a critical alarm shall be generated and the storage tank shall be placed into offline mode.

#### 2.13.1.2.6 Storage Tank High High Level

If fluid reaches high high level indicator a critical alarm shall be generated and the storage tank shall be placed into offline mode.

#### 2.13.1.2.7 Sensor Fault

If during heat mode or hold mode any temperature sensor is out of range by more than 5 degrees F (adjustable) from other sensors for more than 60 seconds, then a general alarm shall be generated.

#### 2.13.1.2.8 Sensor Failure

If during heat mode or hold mode any temperature sensor is out of range by more than 10 degrees F (adjustable) from other sensors for more than 60 seconds, then a critical alarm shall be generated and the EDS system shall be placed into offline mode. User has capability to disable failed sensor and system may be put back into operation ignoring sensors which are disabled.

#### 2.13.1.2.9 Process Fault

If the system hold mode is forced to restart due to a drop below setpoint, then a general alarm shall be generated.

#### 2.13.1.2.10 Decontamination Flow/Temperature Not Reached Alarm

Provide an alarm that activates after a field adjustable amount of time that the waste is recirculated back to the storage tank. This alarm will indicate that the system is not successfully discharging waste to the building drainage system within the anticipated time.

#### 2.14 BAS INTERFACE

The EDS control system shall not send information to the BMS. However, the BMS will include an EDS room leak detection signal that will send a signal to the EDS system to initiate a shutdown of the system if a leak is detected in the EDS room.

The EDS vendor shall include the capability of future connection to the site system through BACnet. All EDS alarms and transmitter data shall be capable of being sent in the future if the design intent changes.

### PART 3 EXECUTION

#### 3.1 DESIGN

Manufacturer shall coordinate with contractor for verification of all dimensions prior to manufacturing any equipment. Manufacturer/contractor shall notify A/E immediately of any conflicts with the design documents and actual field conditions before modifying the general design layout. Manufacturer is responsible for identification of any modifications to equipment skids to accommodate the installation.

Refer to drawings for general design layout for each piece of equipment.

#### 3.2 FACTORY ACCEPTANCE TEST

Vendor shall schedule a minimum of one full day at the factory and provide a notification of testing date a minimum of 15 days prior to actual factory test.

Vendor shall have all equipment and controls in place to demonstrate complete system operation. Vendor shall demonstrate system operation.

Vendor shall have all necessary documentation to verify all components meet the specification.

Refer to the performance requirements section of the 22 72 00.01 data sheet regarding the anticipated amount and constituents of solids.

Refer to commissioning narrative in Chapter 6, Section H20, Paragraph 2 for additional requirement for testing of the removal/reduction of solids by adding them to the waste stream processed by the EDS.

The FAT shall be executed using the same layout, an FAT of the entire system (except the field fabricated tanks) shall be performed, that will be installed at the site. The identical layout of the piping and equipment, except the field fabricated tanks, shall ensure the successful installation at the site. The EDS vendor shall work with the successful design build contractor and the government to ensure the field conditions are fully understood. As an option, the EDS vendor/design build contractor shall submit an approach to reduce the FAT down to a single complete processing train. The FAT price shall be broken out separately

so that cost and approach can be evaluated and compared between all bidders.

The EDS vendor shall test and demonstrate at the Factory that the EDS system will Decontaminate *Bacillus Stearothermophilus*. Verification shall be with spore strips and/or ampoules for verifying the 6 log reduction during a deactivation cycle. The microorganisms shall be placed in a sample port location in the EDS tube skid. The log 6 deactivation will be successful if there is complete killing of 10<sup>6</sup> concentrations of cells.

A/E / Government have the right to reject the FAT document if it does not conform to the design intent.

### 3.3 SHIPPING AND INSTALLATION

All equipment shall be shipped in protective skids or containers. Cover all openings prior to shipping, and remain covered until installation.

Store equipment in a secure dry storage area, protected from weather, construction debris, and construction traffic.

Install equipment according to manufacturer's instructions.

DO NOT INSTALL HEPA FILTERS until request for installation is approved by Government. Room finishes, and piping systems for effluent decontamination system shall be 100% complete and clean of all construction debris and dust before installation of HEPA filters.

### 3.4 SYSTEM START-UP

Pre-start procedures. The EDS vendor shall complete and submit Pre-start procedures including Point to Point Verification before scheduling start up. The EDS vendor shall be on site during start up. The EDS vendor shall provide schedule to contractor for start up and testing and coordinate schedule with installation contractor and A/E and Government. Schedule shall allow for testing of all components and all modes of operation including failures.

Final tests shall include full operational parameters including specified temperatures and cycle times.

Any failed components or control sequences shall be rectified by the EDS vendor at no additional costs, and testing of those failed components or sequences shall be re-performed after repairs are made.

The EDS vendor shall operate system for owner to perform a biological validation of each EDS tube skid.

EDS vendor to provide a list of recommended spare parts needed to successfully start-up the system.

### 3.5 HEPA VENT FILTER VALIDATION

Provide a minimum of 15 days notice to A/E and Government of testing schedule.

Filter Efficiency Test.

a. Filter manufacturer shall provide field testing equipment required to

perform an in place water intrusion test to verify the HEPA grade of the filter.

- b. Each filter shall be tested in place using manufacturers recommended validation procedures.
- c. Any filter not meeting minimum specified test criteria, shall be discarded and replaced at manufacturer's expense.
- d. Provide verification identification on each filter housing identifying test efficiency achieved by installed filter, and date test was performed.

Provide field report indicating test procedures and results for each housing and filter tested.

### 3.6 COMMISSIONING

Refer to Section 01 91 00.15 - TOTAL BUILDING COMMISSIONING for commissioning requirements.

### 3.7 DEMONSTRATION AND INSTRUCTION

- a. The EDS vendor shall provide demonstration and instruction services as part of the base bid, unless otherwise indicated. This shall include, but not be limited to, furnishing the services of a qualified representative to inspect the installation of each piece of equipment, perform instrument calibrations, perform start-up of the entire system including the control system and verify proper performance of all system components in all applicable modes of operation. After successful completion of the system startup, the Manufacturer's representative shall train the Owner's operating personnel in proper operation of the system including all control functions, and the Manufacturer's recommended cleaning and sanitization procedures.
- b. Startup and training activities shall be indicated on the overall manufacturing schedule to be supplied by the EDS vendor.
- c. The EDS vendor shall provide start-up assistance and training at the Owner's facility. The vendor shall recommend the duration and cost of the training in the Bid Proposal as a separate line item. Any additional time required by the Owner shall be provided at the Vendor's published rates. Field assistance required at the site due to faulty workmanship, inoperable controls, or malfunctions of equipment or controls provided by the Vendor shall not be counted towards the training/start-up allowance.
- d. The Vendor training of the Owner's operating and maintenance personnel shall include, but is not limited to:
  - (1) Start-up and shut-down procedures
  - (2) Typical operations
  - (3) Emergency shutdown
  - (4) Safety training
  - (5) Troubleshooting procedures
  - (6) Control system and instrumentation operation and diagnostics
  - (7) Control system hardware maintenance
  - (8) Servicing and preventative maintenance schedules and procedures
  - (9) Secondary containment or containable barrier features

- e. Instruction must be conducted using submitted and approved O & M documents and a video of the instruction shall be provided for future reference.

-- End of Section --

DRAFT

SECTION 23 09 93

SEQUENCES OF OPERATION FOR HVAC CONTROL  
08/22

PART 1 GENERAL

**NOTE:** Sequence of Operations are provided as a guideline to the design professional based on the included concept drawings. It is the responsibility of the design professional to provide detailed Sequence of Operations as required based on final equipment selections.

**NOTE:** Some specification sections referenced are not a part of this issue. The Design Build Contractor shall include these specifications as required during the next phase of the project.

1.1 DEFINITIONS

For definitions related to this Section, see Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

1.2 GENERAL REQUIREMENTS

- a. This section defines the manner and method by which controls for USAMRIID - SSP Replacement Project shall function. Equipment, devices, and system components required for control systems are specified in other sections.
- b. All timing devices, alarm setpoints and control set points shall be adjustable. Setpoints listed herein for duct/room static pressure control, differential pressure control for discharge/intake isolation dampers, outside air flow control, return fan air flow tracking volume, and static pressure safeties are initial starting values. Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC shall coordinate with Section 23 05 93.00 10 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS during testing and balancing for final setpoints. AHU system static pressure and branch duct static pressure setpoints to be determined upon final balancing of room air terminal devices.
- c. Existing base building global outside air temperature, humidity and carbon dioxide (CO2) measurement, for control and monitoring applications shall be used.
- d. All hardwired and calculated points shall be shown on the associated graphic screens for monitoring purposes.
- e. All VFD and motor starter Hand-Off-Auto switches shall be monitored. Anytime the VFD or motor starter H-O-A is placed out of the AUTO position, the UMCS shall be alarmed.
- f. Provide software alarm points as follows:
  - (1) Digital points: Alarm upon change of state from Normal condition.
  - (2) Analog points: Alarm upon a high or low value based on a deviation from setpoint as follows, unless otherwise noted:

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- (a) Temperature: Plus or Minus 3 degrees F.
- (b) Duct Pressure: Plus or minus 0.50 inches w.c.
- (c) Room Pressure: Plus or Minus 0.04 inches w.c., after a 15 second time delay.
- (d) Duct Humidity: Plus or Minus 10 percent RH.
- (e) Room Humidity: Below 35 percent RH or greater than 65 percent RH.
- (3) All software alarms shall have a sliding deviation window which is directly linked to the setpoint, such that changing the setpoint will automatically change the high and low alarm setpoints with the original deviation limits without operator intervention, unless the deviation band is required to be adjusted.
- (4) All alarm points shall have a time delay adjustment from 0-300 seconds.
- g. Where the term "GPPC" is used in this Section, it refers to either General Purpose Programmable Controllers or Supervisory Controller (SC), as defined in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.
- h. The controls contractor shall minimize the use of interposing relays. If the controls contractor determines there is a need to use interposing relays, the controls contractor shall clearly document where the proposed relays will be used on the shop drawings, provide justification, and shall obtain approval from the government for each application prior to installation. The following is a partial list of examples where the use of interposing relays is not acceptable.
  - (1) Safeties for AHUs such as pressure switches and freezestats shall be wired directly to the fan VFD/starter and the DDC panel.
  - (2) Safeties for EF/HRUs such as pressure switches shall be wired directly to the fan VFD/starter and the DDC panel.
  - (3) DDC start/stop signal shall be wired directly to the fan and pump VFD/starter.
  - (4) Where supply fans and return fans are hardwired interlocked, utilize auxiliary contacts from the VFD/Starter.
- (i) For all AHUs with roughing humidification control, the humidity high limit alarms shall be suppressed any time the "Humidification Mode" is indexed OFF.

### 1.3 SUBMITTALS

Submittals related to this Section are specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

### 1.4 SOFTWARE LOGIC

The system shall have the ability to suppress system parameter alarms at all workstations, when the associated AHU is de-energized through the UMCS



workstation. If a unit failure occurs or the unit trips on a safety device, all workstations shall receive an alarm signal, while space parameters (T, H, P) continue to be monitored. Coordinate which system parameter alarms shall be suppressed with government prior to implementation.

## PART 2 PRODUCTS

Products related to this Section are specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and related Sections 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC and 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

## PART 3 EXECUTION

### 3.1 AT/SF EMERGENCY SHUTDOWN SEQUENCE

- a. The Government shall be able to manually initiate the shutdown of all HVAC and Mechanical systems controlled by the Utility Management and Control System (UMCS) from any operator workstation within the building.
- b. There shall be a software point displayed at the operator workstation for each system to indicate if the specific system is enabled or disabled. The operator shall be able to manually override the "system enable" from the operator workstation, with the proper authorization.
- c. The following systems shall have enable/disable software points, which shall be displayed on a graphics screen titled "AT/SF EMERGENCY SHUTDOWN":
  - (1) Steam Sterilization HVAC Systems
  - (2) EDS Process Control System
- d. Only authorized individuals shall be able to enable and disable systems. The security settings for each point shall be defined by the user. The system shall allow for each point to be configured uniquely.
- e. The systems shall de-energize in such a fashion as to maintain the pressure relationships within the spaces during the shutdown routine. For negatively pressurized spaces, supply systems shall be disabled first, then exhaust system. For positively pressurized spaces the exhaust shall be disabled first, then the supply systems. In this mode the standby systems shall not be started when primary units are shutdown.
- f. The shutdown routine for a specific system shall take no more than 3 minutes.

### 3.2 RETURN FROM POWER FAILURE OR EMERGENCY SHUTDOWN

- a. The Government shall be able to restart all HVAC and Mechanical systems controlled by the Utility Management and Control System (UMCS) from any operator workstation within the building.
- b. There shall be a software point displayed at the operator workstations which will allow the operator to globally restart the entire facility automatically. The operator shall also have the ability to enable

each system individually.

- c. The UMCS shall automatically restart the system, without operator intervention, upon a return to normal power. The existing sequence shall be modified to accommodate the new systems. The following systems shall be enabled in sequence and in 5 second intervals:

- (1) Individual Hot Water Distribution Systems (existing)
- (2) Cooling Tower System (existing)
- (3) Chilled Water System (existing)
- (4) Process System (existing)
- (5) ABSL/BSL-4 Exhaust Systems (existing)
- (6) ABSL/BSL-4 Supply Systems (existing)
- (7) Non-Containment Corridor Systems (existing)
- (8) (A)BSL-3E Exhaust Systems (existing)
- (9) (A)BSL-3E Supply Systems (existing)
- (10) ABSL-2 Exhaust Systems (existing)
- (11) ABSL-2 Supply Systems (existing)
- (12) BSL-2 Exhaust Systems (existing)
- (13) BSL-2 Supply Systems (existing)
- (14) Steam Sterilization Plant HVAC Systems (added)
- (15) EDS Process Control Systems (added)
- (16) Office Systems (existing)
- (17) Logistics Systems (existing)
- (18) Atrium Systems (existing)
- (19) Heat Recovery System (existing)

### 3.3 STEAM STERILIZATION PLANT AIR SYSTEM CONTROL

#### 3.3.1 Steam Sterilization Plant Air Systems

- a. Steam Sterilization AHU System

- (1) AHU-1 / EF-1 / EF-2 / HF-1

#### 3.3.2 General

- a. These systems serve the Steam Sterilization Plant area located on 1st floor. The requirements identified in this section apply to all SSP air handling units, exhaust fans, and HEPA filter, unless noted otherwise.
- b. The AHU systems above are classified as 100 percent outside air, constant pressure systems. Each system shall condition the air twenty-four (24) hours per day, seven (7) days per week to satisfy the associated rooms' temperature, pressurization, and relative humidity setpoints.
- c. There shall be a software point displayed at the operator workstation for each AHU and exhaust fan to indicate if the specific system is enabled or disabled. The operator shall be able to manually override the "system enable" from the operator workstation to shutdown the systems for maintenance. Only operators with the proper authorization shall be allowed to shutdown systems.
- d. Each AHU system includes supply air and exhaust air sections. These segregated sections provide heat recovery capabilities via a heat pipe.
- e. HEPA filter units are provided to meet the filtered air requirements

for the SSP.

- f. The UMCS shall monitor the run status of each Fan VFD through an independent current transmitter. The enable/disable and speed signals shall be directly wired to the GPPC controlling the fan. The UMCS shall monitor all other available points in the VFD via the communication card, which will be provided by the VFD manufacturer. In the event the fan motor does not prove "on" or a VFD drive fault alarm is present, the fan shall be commanded "off" by UMCS and an alarm generated at the UMCS. The following conditions shall generate an alarm on the UMCS:
- (1) The fan status does not coincide with the commanded state of the VFD after a 30 second delay. The software setpoint associated with the current transmitter which indicates "on" status vs. "off" status shall be set so that a belt breakage indicates "off" status.
  - (2) The drive indicates a VFD drive fault alarm.
- g. The UMCS shall monitor the differential pressure across air handling unit (2) pre-filters, and exhaust air filter, with a differential pressure sensor/transmitter. An alarm shall be generated upon high differential pressure. Pre-filters shall be alarmed when the differential pressure increases above 1.5 inches w.c.
- h. In addition to the system parameters identified in the following paragraphs that are used for monitoring and/or controlling of the system operation, the UMCS shall monitor the following system variables:
- (1) For Steam Sterilization Plant AHU System:
    - (a) Supply Air Temperature Downstream of the Heat Pipe.
    - (b) Supply Air Temperature Upstream of the Heat Pipe.
    - (c) Exhaust Air Temperature Upstream of the Heat Pipe.
    - (d) Exhaust Air Temperature Downstream of the Heat Pipe.
  - i. AHU-1 shall operate on emergency power. The control panels and all associated control instruments and devices shall be powered from a Power Distribution Unit (PDU).

### 3.3.3 System Activation/De-Activation Control

- a. Upon initial building start-up or return from power outage, the UMCS shall stagger the startup of the fan systems to maintain building pressure as close to equal as possible.

Recommended start-up sequence is as follows (time delays in absolute time, not cumulative time intervals):

GROUP	TIME DELAY	SSP HVAC EQUIPMENT	SUPPLY FAN SPEED	EXHAUST FAN SPEED
1	0 seconds	EF-1	N/A	15Hz
2	3 seconds	AHU-1	N/A	15Hz

- b. Once all of the equipment is proven "on", the terminal units served by this system shall be released to maintain their respective flow setpoints.
- c. The exhaust fan speed control shall be enabled, and the exhaust fan system shall ramp the fans over a 2 minute period to maintain the exhaust duct static pressure at setpoint.
- d. The supply fan speed control shall be enabled, and the AHU system shall ramp the fans over a 5 minute period to maintain the supply duct static pressure at setpoint.
- e. Upon de-activation of the system (consisting of the equipment listed above), all terminal unit control loops shall be disabled.

#### 3.3.4 Exhaust Fan Control

- a. The SSP exhaust fan systems is classified as a constant pressure systems. The requirements identified in the paragraphs that follow apply to the operation the SSP exhaust system, unless noted otherwise.
- b. The EF-1 and EF-2 are N+1, each sized for 100% of system capacity. During normal operation, both EF shall run at reduced capacity. In the event of failure or maintenance shutdown, the remaining EF shall automatically ramp up speed to maintain system pressure setpoint.
- c. If the exhaust fan is enabled through the HOA switch provided with the VFD or through the UMCS when the VFD is in the "Auto" position, the following sequence shall occur:
  - (1) The inlet air isolation damper shall be hardwire interlocked with the fan VFD. When the unit is commanded "on" the inlet air isolation damper shall open, once the damper proves open with the associated limit switch the fan shall start. If at any point during operation, the limit switch indicates the damper is closing, the EF shall be shutdown and commanded "off" by the UMCS.
  - (2) The differential pressure across the EF's discharge isolation damper shall be monitored with a differential pressure switch (DPS). In the event the differential pressure across the damper decreases below 0.25 inches w.c., the damper shall open, there shall be a minimum of 0.04 inches w.c. deadband between transitions. The DPS shall be hardwire interlocked with the solenoid valve supplying main air to the damper actuator. The damper position shall be monitored on the UMCS. Once the fan is proven "on", that exhaust fan speed shall be controlled through the VFD in a manner not to produce excessive positive pressure during start-up. Upon shutdown, the reverse shall occur.

#### 3.3.5 Exhaust Fan Pressure Control

##### 3.3.5.1 Exhaust Fans (EF-1, EF-2)

- a. The UMCS shall monitor the exhaust static pressure at reference point. No control loops shall be controlled over the communication network.
- b. The fan speed shall modulate to maintain the exhaust duct static pressure at a setpoint, initially 1.0 inches w.c. On a drop in static

pressure below setpoint the fan speed shall increase, on a rise the reverse shall occur.

- c. The UMCS shall monitor the exhaust fan status for the AHU, in the event that the AHU is not operating, the UMCS shall disable the control loop, and command the outputs to minimum.
- d. Whenever the SSP exhaust fan is de-energized, the supply fan shall also be de-energized. All control loops shall be inactive. Refer to SSP failure sequences (see paragraph "BSL-2 Failure Sequences") for conditions when one or both of exhaust fans are de-energized.

#### 3.3.6 Exhaust Fan Soft Start / Stop

- a. Provide an unloaded fan start sequence (soft start) for each exhaust fan. This feature ensures the UMCS slowly accelerates fan speed to a minimum speed upon initial startup. The VFD shall ramp fan speed to the control setpoint in a smooth, bumpless, trouble-free manner over a 2 minute period.
- b. The UMCS shall decelerate fan speed to minimum and disable control loops when system shuts down. During system shutdown, each smoke/isolation damper shall close.

#### 3.3.7 Exhaust Fan Unit Safeties

- a. A low static pressure condition upstream and/or downstream of an exhaust fan shall cause that exhaust fan to be indexed "off" and generate an alarm at the UMCS. The remaining exhaust fan speed shall be ramped maintain duct static pressure. Hardwire the high and low static pressure overrides to their respective fan VFD control circuit; provide an alarm signal at the UMCS whenever the high or low static pressure setpoint is exceeded. The high and low static pressure switches shall be manually reset. The high and low static pressure setpoints shall be equal to the associated exhaust duct classification.
- b. Safety devices shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand" and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

#### 3.3.8 Air Handling Unit Supply Fan Control

- a. The AHU system is classified as 100 percent outside air, constant pressure systems. The requirements identified in the paragraphs that follow apply to the operation of the SSP AHU systems, unless noted otherwise.
- b. Upon confirmation that the associated exhaust systems are running, the air handling unit control loops shall be enabled.
- c. If the unit is enabled through the HOA switch provided with the VFD or through the UMCS when the VFD is in the "Auto" position, the following sequence shall occur:
  - (1) The outside air and discharge isolation dampers shall be hardwire interlocked with the supply fan VFD. When the unit is commanded "on" the outside air and discharge isolation damper shall open, once the dampers prove open with the associated limit switches the

supply fan shall start.

(2) Once the fan is proven "on", the supply fan shall be controlled via modulation of its fan speed in a manner not to produce excessive positive pressure during start-up. Upon shutdown, the reverse shall occur.

- d. If at any point during operation, the limit switches indicates either damper is closing, the AHU shall be shutdown and commanded "off" by the UMCS.
- e. Upon failure of a supply fan, the failed unit shall be commanded off and an alarm shall be generated at the UMCS.

### 3.3.9 Air Handling Unit Supply Fan Pressure Control

- a. The UMCS shall monitor the supply duct static pressure at reference point. No control loops shall be controlled over the communication network.
- b. The supply fan speed shall modulate to maintain the supply duct static pressure at a setpoint, initially 1.0 inches w.c. On a drop in static pressure below setpoint the fan speed shall increase, on a rise the reverse shall occur.
- c. The UMCS shall monitor the exhaust fan status, in the event that the exhaust fan is not operating, the UMCS shall disable the control loop, and command the outputs to minimum, commanded the AHU off and an alarm shall be generated at the UMCS.

### 3.3.10 Air Handling Unit Fan Soft Start

- a. Provide an unloaded fan start sequence (soft start) for each supply fan. This feature ensures the UMCS slowly accelerates fan speed to a minimum speed upon initial startup. The VFD shall ramp fan speed to the control setpoint in a smooth, bumpless, trouble-free manner over a 2 minute period.
- b. The UMCS shall decelerate fan speed to minimum and disable control loops when system shuts down. During system shutdown, each smoke/isolation damper shall close.

### 3.3.11 Temperature Control

- a. The AHU will be provided with a heat pipe. The heat pipe will provide supplemental passive heating of the supply air to the unit in the winter (or heating) months or supplemental passive cooling of the supply air to the unit in the summer (or cooling) months.
- b. In addition to the heat recovery described above, each AHU will be provided with a pre-heat coil (upstream of the heat pipe) and a cooling coil (downstream of the heat pipe). The pre-heat coil will be provided with a 3-way temperature control valve. The cooling coil shall be provided with a pressure independent control valve.
- c. Pre-heat Coil Temperature Control:

(1) The pre-heat coil control valve shall modulate to maintain the heat pipe discharge temperature setpoint.

(2) Upon a decrease in heat pipe discharge air temperature, the control valve shall modulate open to maintain the desired setpoint. The reverse sequence shall occur upon an increase in heat pipe discharge air temperature.

(3) Cooling coil valve shall be closed.

d. Cooling Coil Temperature Control:

(1) The cooling coil control valve shall modulate to maintain the unit discharge temperature setpoint.

(2) Upon an increase in unit discharge air temperature, the control valve shall modulate open to maintain the desired setpoint. The reverse sequence shall occur upon a decrease in this discharge air temperature.

(3) Pre-Heat coil control shall be closed.

e. Heat Pipe Frost Protection:

(1) In the event the outside air temperature is below 12 Degrees F, the heat pipe bypass damper shall be opened for frost protection.

(2) In the event the outside air temperature is above 15 Degrees F, the heat pipe bypass damper shall be closed to allow for heat recovery.

3.3.12 Air Handling Unit Humidity Control

a. Upon starting fan system, the UMCS shall delay activation of humidification control until after the unit dry bulb temperature has stabilized (5 minute time-delay)

b. The UMCS shall monitor discharge air humidity and temperature. The discharge dew point temperature shall be calculated. The dew point value shall be displayed on the AHU graphic screen.

c. The humidifier valve shall modulate to maintain the dew point temperature at setpoint. Upon a rise in dew point above setpoint, the humidifier valve shall modulate closed. Upon a drop in dew point, the reverse shall occur.

d. The dew point setpoint shall be reset by the humidity sensor located in the exhaust duct. Upon a decrease in humidity below a setpoint of 35 percent RH, the discharge dew point setpoint shall be reset from 35 to 45 degrees F. Upon an increase in exhaust humidity the reverse shall occur.

e. Whenever discharge air humidity exceeds 85 percent RH, the respective humidifier control valve shall be modulated closed over a 1 minute period and alarm shall be generated at the UMCS Supervisory Station. Humidity control shall resume when the humidity drops below 78 percent.

3.3.13 Humidifier Isolation Valve

The humidifier isolation valve shall be indexed open by the UMCS when the outdoor air dewpoint drops below 46 degrees F, for more than 5 minutes,

which shall index the AHU into "Humidification Mode". The valve shall remain open until outdoor air dewpoint rises 3 degrees F above setpoint for 5 minutes. Isolation valves shall be slow opening and closing to prevent condensate slugging and hydronic shock. Isolation valve shall be open prior to humidity control valve.

#### 3.3.14 Air Handling Unit Safeties

- a. Whenever the supply fan is de-energized, the exhaust fan shall be de-energized; its outside air, discharge isolation, and exhaust air isolation dampers shall close; its preheat coil and cooling coil control valves shall close. The humidifier valve shall close. All control loops shall be inactive, with the exception of the preheat temperature loop, which shall modulate the preheat coil valve to maintain the coil discharge temperature of 45 degrees F, when the outside air temperature is 38 degrees F or below.
- b. Cooling coil control valve shall remain open when low temperature detector switch is activated. Under all other shutdown events, cooling control valve shall close.
- c. During normal operation, low temperature detectors (freezestats) shall transmit an alarm to UMCS whenever the temperature of the supply air downstream of the AHU heat pipe or pre-heat coil falls below 35 degrees F. The low temperature detectors shall be hardwired to their respective fan VFD control circuit to shutdown the fan. The remaining exhaust fans in this system shall continue to operate similar to as described in paragraph "Air Handling Unit Failure Sequences". Low temperature detectors shall be manually reset before the alarm can be cleared and system restarted.
- d. A high static pressure condition downstream or low static pressure condition upstream of a supply fan or exhaust fan shall cause the fan to be de-energized and an alarm generated. Hardwire high and low static pressure overrides to their respective fan VFD control circuit to shutdown the fan; provide separate alarm signals to UMCS whenever either the high or low static pressure set points are exceeded. The remaining exhaust fans in this system shall continue to operate similar to as described in paragraph "Air Handling Unit Failure Sequences". High and low static pressure switches shall be manually reset. The high static pressure setpoint and low static pressure setpoint shall be equal to the duct classification shown on the flow diagrams.
- e. UMCS shall monitor supply air smoke detector(s) provided by Division 28. Each smoke detector shall generate an alarm to UMCS through an interface relay and de-energize its respective fan through the UMCS.
- f. Safety devices (except smoke detectors) shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand" and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.

#### 3.3.15 Air Handling Unit Failure Sequences

- a. Safety devices (except smoke detectors) shall be hardwired to the respective fan's VFD. Hardwired safety devices must be active in "Hand" and "Auto" positions. When a safety is activated, the system shall shutdown in a controlled manner.



## Repair Steam Sterilization Plant (SSP)

Item	Description	Method
1	AHU control equipment indexes to failed position	Hardwire interlock
2	In positively pressurized spaces, the exhaust air and supply air terminals will close.	Resident software interlock with each terminal unit
3	In negatively pressurized spaces, the exhaust air terminal's flow setpoints will be reduced according to mechanical schedules, the supply air terminals will close.	Resident software interlock with each terminal unit
4	The exhaust fan will track downward to maintain the exhaust duct static setpoint.	Software interlock

b. If the AHU is restored, the following will occur in sequence:

Item	Description	Method
1	The disabled AHU is enabled.	Software interlock
2	The AHU fan speed slowly increases until the control setpoint is maintained.	Software interlock
3	All supply and exhaust terminal equipment are reset to normal flow setpoints.	Software interlock
4	The exhaust fan shall track to maintain the duct static setpoint.	Resident software interlock with each terminal unit

### 3.3.16 Exhaust Fan Failure Sequences

a. If an exhaust fan is disabled due to a safety (including: low suction pressure, isolation damper limit switch indicates a closed damper, or fan does not prove "on") the following will occur in sequence:

Item	Description	Method
1	EF control equipment indexes to the failed position.	Hardwire interlock

## Repair Steam Sterilization Plant (SSP)

Item	Description	Method
4	The remaining EF speed shall be ramped to maintain duct static pressure setpoint.	Software interlock
5	The failed EF shall be commanded OFF.	Software interlock

B. If the EF is restored, the following will occur in sequence:

Item	Description	Method
1	The operating EF remains operating.	Software interlock
2	The disabled EF is enabled.	Software interlock
3	The EF returning to operation speed increases until the differential pressure across the isolation damper equalizes. Once the pressure equalizes the damper shall open.	Software interlock
4	The exhaust fan speed of both EF are ramped to the same speed to maintain exhaust duct static pressure.	Software interlock

c. If a second EF is disabled due to a safety, the following will occur in sequence:

Item	Description	Method
1	EF control equipment indexes to failed position	Hardwire interlock
2	In negatively pressurized spaces, the exhaust air and supply air terminals will close.	Resident software interlock with each terminal unit
3	In positively pressurized spaces, the supply air terminal's flow setpoints will be reduced according to mechanical schedules, the exhaust air terminals will close.	Resident software interlock with each terminal unit

## Repair Steam Sterilization Plant (SSP)

Item	Description	Method
4	The supply fan will ramp down to minimum speed and be commanded off.	Software interlock

### 3.3.17 HEPA Filter Monitoring

The UMCS shall monitor the differential pressure across the air handling unit HEPA filter with a differential pressure sensor/transmitter. An alarm shall be generated upon high differential pressure. The alarm setpoint for the HEPA filter shall be initially set at 2.75 inches w.c.

### 3.3.18 Exhaust Fan Maintenance Modes

- a. Tight close-off isolation dampers shall be provided upstream and downstream of the each Exhaust Fan.
- b. Activate Maintenance mode, via a manual command from the UMCS operator, the EF in maintenance mode shall be commanded to minimum speed. Remaining exhaust fan speed shall ramp to maintain duct static pressure. EF in maintenance mode shall be commanded off once at minimum speed and isolation dampers shall close. Upon proof of closure via end-switches a notification shall be activated on the operator workstation indicating "EF-#in Maintenance Mode".
- c. Deactivate Maintenance mode, via a manual command from the UMCS operator, the EF shall be restarted as specified in Paragraph 3.3.4.c. Upon proof of EF operating a notification shall be activated on the operator workstation indicating "EF-# in Normal Mode".

### 3.3.19 Exhaust Tunnel Maintenance Modes

- a. Tight close-off isolation dampers shall be provided upstream and downstream of the AHU Exhaust Tunnel with a by-pass duct and damper around the AHU Exhaust Tunnel.
- b. Activate Maintenance mode, via a manual command from the UMCS operator, the AHU Exhaust Tunnel bypass damper shall open. Upon proof of open via end-switch the, the AHU Exhaust Tunnel isolation dampers shall be closed. Upon proof of closure via end-switches a notification shall be activated on the operator workstation indicating "AHU Exhaust Tunnel in Maintenance Mode".
- c. Deactivate Maintenance mode, via a manual command from the UMCS operator, the AHU Exhaust Tunnel isolation dampers shall be opened. Upon proof of open via end-switches, the AHU Exhaust Tunnel bypass damper shall close. Upon proof of closure via end-switch a notification shall be activated on the operator workstation indicating "AHU Exhaust Tunnel in Normal Mode".

### 3.3.20 HEPA Filter Maintenance Modes

- a. Bubble tight isolation dampers shall be provided upstream and downstream of the HEPA filter unit with a by-pass duct and damper around the HEPA filter unit.

- b. Activate Maintenance mode, via a manual command from the UMCS operator, the HEPA filter bypass damper shall open. Upon proof of open via end-switch the, the HEPA filter isolation dampers shall be closed. Upon proof of closure via end-switches a notification shall be activated on the operator workstation indicating "HEPA Filter in Maintenance Mode".
- c. Deactivate Maintenance mode, via a manual command from the UMCS operator, the HEPA filter isolation dampers shall be opened. Upon proof of open via end-switches, the HEPA filter bypass damper shall close. Upon proof of closure via end-switch a notification shall be activated on the operator workstation indicating "HEPA Filter in Normal Mode".

### 3.4 TYPICAL SSP ROOM CONTROL

#### 3.4.1 General

Most rooms shall be provided with constant air volume terminal units on the supply air ductwork and exhaust air ductwork. In these rooms, temperature shall be controlled from temperature sensors installed in the exhaust air ductwork. Room pressurization will be maintained based on volumetric offset tracking control, supply shall track exhaust for negative rooms and exhaust shall track supply for positive rooms. In addition, the volumetric offset setpoint shall be reset based on space differential pressure as measured against adjacent space. In rooms with no exhaust air ductwork (i.e., Control Display Room), space temperature sensors shall be provided. In many rooms, humidity sensors shall be provided and installed in the exhaust ductwork to monitor the relative space humidity.

All supply air terminal units shall be provided with reheat coils to provide supplemental heating. Certain rooms are provided with Fan Coil Units for supplemental cooling. Refer to airflow diagrams and floor plans for identification of rooms that require relative humidity monitoring and rooms that require supplemental cooling via Fan Coil Units.

No more than 2 rooms shall be controlled from a single GPPC or ASC. All terminal units in a single room which are required to operate in concert to execute a control strategy defined in the sequence of operations shall be controlled from a single controller, the use of multiple controllers is unacceptable.

#### 3.4.2 Disable Controls

The UMCS shall disable room temperature and pressurization controls when the associated supply air handling unit is off. The hot water reheat control valves shall fail closed; for positively pressurized spaces the supply air terminal unit shall fail open and the exhaust air terminal units shall fail close; for negatively pressurized spaces the supply air terminal unit shall fail close and the exhaust air terminal units shall fail open. Control loops shall be enabled when system AHU is operational.

#### 3.4.3 Supply Air Terminal Temperature & Flow Control

- a. The supply air terminal unit damper shall be modulated to maintain airflow at setpoint. For positively pressurized spaces the supply air flow setpoint shall be as scheduled. For negatively pressurized spaces the supply air flow setpoint shall be dictated by the total exhaust

air flow from the space minus a flow differential. Refer to airflow diagrams to determine flow differential (i.e. total transfer air).

- b. The airflow differential shall be reset via cascade loop control to maintain room differential pressure at setpoint.
- c. The reheat coil control valve shall be modulated to maintain space temperature (exhaust duct temperature) at setpoint. Upon a drop in space temperature below its setpoint, the UMCS shall modulate the normally closed hot water reheat control valve toward its open position to maintain the room temperature at its setpoint. Upon an increase in space temperature above its setpoint, the reverse sequence shall occur.
- d. High and low temperature alarms shall be reported at the UMCS supervisory station. Alarm setpoint are outlined in Paragraph 1.2 "General Requirements" subparagraph f(2), above.
- e. High and low supply air flows shall be reported at the UMCS supervisory station. Alarm setpoint are outlined in Paragraph 1.2 "General Requirements" subparagraph f(2), above.
- f. Provide a trending program in accordance with a Government defined format and time period. Data shall be downloaded to an archive media, provided by the Government, as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

#### 3.4.4 Exhaust Air Terminal Unit Flow Control

- a. The exhaust air terminal unit damper shall be modulated to maintain airflow at setpoint. For negatively pressurized spaces the exhaust air flow setpoint shall be as scheduled. For positively pressurized spaces the exhaust air flow setpoint shall be dictated by the total supply air flow from the space plus a flow differential. Refer to airflow diagrams to determine flow differential (i.e., total transfer air).
- b. High and low exhaust air flows shall be reported at the UMCS supervisory station. Alarm setpoint are outlined in Paragraph 1.2 "General Requirements" subparagraph f(2), above.
- c. Provide a trending program in accordance with a Government defined format and time period. Data shall be downloaded to an archive media, provided by the Government, as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

#### 3.4.5 Supplemental Fan Coil Unit Control

- a. For spaces served by supplemental fan coil units, FCU shall operate in concert with the supply terminal unit temperature control loop to provide supplemental cooling and/or heating to the space served. Refer to mechanical drawings for locations.
- b. In the event the reheat coil control valve is fully closed and space temperature is above setpoint, the UMCS shall command the FCU fan "ON" and modulate the normally closed chilled water coil control valve toward its open position to maintain the room temperature at its setpoint. Upon a decrease in space temperature below its setpoint, the reverse sequence shall occur. Once cooling coil control valve is

fully closed, the FCU fan will be commanded "OFF" after a 5-minute time delay (adjustable).

- c. In the event the reheat coil control valve is fully open and space temperature is below setpoint, the UMCS shall command the FCU fan "ON" and modulate the normally closed heating water coil control valve toward its open position to maintain the room temperature at its setpoint. Upon an increase in space temperature above its setpoint, the reverse sequence shall occur. Once heating coil control valve is fully closed, the FCU fan will be commanded "OFF" after a 5-minute time delay (adjustable).

#### 3.4.6 Differential Pressure Monitoring

- a. Each room shall reference its adjacent space, as indicated on M-600 Airflow diagram.
- b. A differential pressure sensor shall sense the differential pressure between the applicable room and the reference corridor reference point, and shall transmit a 4-20 ma dc signal to the controller. Local gauges shall be provided for visual indication to user.
- c. High and low differential pressures shall be reported at the UMCS supervisory station. Alarm setpoint are outlined in Paragraph 1.2 "General Requirements" subparagraph f(2), above.
- d. Provide a trending program in accordance with a Government defined format and time period. Data shall be downloaded to an archive media, provided by the Government, as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

#### 3.4.7 Occupied and Unoccupied Laboratory Control

The terminal units serving SSP spaces shall operate in occupied mode 24 hours per day seven days per week.

### 3.5 CHILLED WATER AND PROCESS COOLING WATER MONITORING

- a. UMCS shall monitor new chilled water supply and return branch temperature and new process chilled water supply and return branch temperatures serving the SSP.
- b. High and low temperatures shall be reported at the UMCS supervisory station. Alarm setpoint are outlined in Paragraph 1.2 "General Requirements" subparagraph f(2), above.
- c. Provide a trending program in accordance with a Government defined format and time period. Data shall be downloaded to an archive media, provided by the Government, as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

### 3.6 HEATING HOT WATER REHEAT DISTRIBUTION SYSTEMS CONTROLS

#### 3.6.1 General

- a. Steam-to-hot water heat exchangers provide the heat source for the AHU Preheat and Supply terminal unit Hot Water Reheat distribution systems.
- b. The heat exchangers shall operate in a primary/secondary

configuration. Both heat exchangers shall have isolation valves.

- c. The system consists of two distribution pumps. Only one distribution pump shall be allowed to operate at any one time; the remaining pump shall provide 100 percent standby operation.
- d. One steam valve station, consisting of a 1/3 control valve and a 2/3 control valve shall serve each heat exchanger.
- e. There shall be a software point displayed at the operator workstation for each system to indicate if the specific system is enabled or disabled. The operator shall be able to manually override the "system enable" from the operator workstation, with the proper authorization.
- f. Hand-Off-Auto selector switch shall be provided at each VFD. The UMCS shall monitor the switch and shall provide an operator alarm when the pump is out of the "Auto" position.
- g. The UMCS shall monitor the run status of each VFD through an independent current transmitter. The enable/disable and speed signals shall be directly wired to the GPPC controlling the pump. The UMCS shall monitor all other available points in the VFD via the communication card, which will be provided by the VFD manufacturer. In the event the pump motor does not prove "on" or a VFD drive fault alarm is present, the pump shall be commanded "off" by UMCS and an alarm generated at the UMCS. The following conditions shall generate an alarm on the UMCS:
  - (1) The pump status does not coincide with the commanded state of the VFD after a 15 second delay.
  - (2) The drive indicates a VFD drive fault alarm.
- h. The UMCS shall monitor the heat exchanger return water flow. The UMCS shall use the following equation to calculate the heat exchanger energy injection:  $(\text{GPM} \times (\text{supply wtr temp} - \text{ret wtr temp}) \times 0.5) = \text{MBH}$ . The calculated value shall be displayed at the operator workstation.
- i. The differential pressure sensor and bypass valve shall be wired to the same GPPC which is controlling the heat exchangers and pumps.

#### 3.6.2 Pump Control

- a. Once the system is enabled via a manually initiated command at the operator workstation, the primary pump shall be enabled.
- b. Pump speed shall be controlled by the UMCS, based upon differential pressure sensor readings measured at one location in the distribution system. The UMCS shall modulate the pump speed to maintain the differential pressure at an initial setpoint of 5 psi, the final setpoint shall be dictated by the TAB. Upon a decrease in differential pressure below setpoint the pump speed shall increase. Upon a rise the reverse shall occur. The pump shall maintain minimum speed shall be dictated by the flow meter. The pumps shall always maintain a minimum of 20 percent system water flow.
- c. In the event the pumps are controlling to 20 percent of the system flow and the differential pressure in the distribution loop increases,

the minimum flow bypass control valve shall modulate open to maintain the system pump operation above 20 percent. The valve shall be controlled from the same pressure signal used to control the pump speed.

- d. The pumps shall alternate to equalize equipment runtime. After the primary pump has operated for 750 hours, an alarm shall be annunciated at the operator workstation indicating the primary pump needs to be alternated. Once the primary pump is alternated, via the operator initiated command, the totalized runtime shall be reset.
- e. There shall be a smooth transition when the standby pump is enabled and there shall be minimal disruption to the system pressure.
- f. In the event the standby pump fails to start, the primary pump shall remain operating.

### 3.6.3 Temperature Control

- a. The primary heat exchanger's isolation valve shall be commanded open.
- b. When the primary heat exchanger valve proves "open" and flow is proven via the flow meter, and, the temperature control loop shall be enabled.
- c. The normally closed steam valves shall modulate to maintain the supply water temperature at 160 degrees F. As the hot water temperature begins to drop below setpoint, the 1/3 control valve shall begin to modulate open. If the 1/3 control valve is 100 percent open and the temperature continues to drop, the 2/3 control valve shall begin to modulate open to maintain setpoint. The reverse sequence shall occur upon a rise in the hot water supply temperature.
- d. In the event both steam valves open 100 percent and the supply water temperature drops 4 degrees below setpoint for a period of 5-minutes or greater and alarm shall be generated at the operator workstation. If steam pressure and temperature serving the heat exchanger are within normal range, the primary heat exchanger shall be disabled and the secondary heat exchanger shall be enabled.
- e. An alarm shall be annunciated on the UMCS in the event any of the following occur:
  - (1) Supply water temperature drops 10 degrees F below setpoint for more than 30 minutes.
  - (2) Supply water temperature rises above 200 degrees F.
  - (3) An isolation valve is commanded open and does not prove open after 15 seconds.
- f. The heat exchangers shall be alternated by a manually initiated command at any UMCS operator workstation.
- g. The primary HE steam valves shall close in the event any of the following occur:
  - (1) Both pumps prove "off".



(2) The isolation valve for the primary heat exchanger closes.

(3) The discharge temperature increases above 200 degrees F.

### 3.7 120 PSIG / 60 PSIG / 15 PSIG STEAM SYSTEM MONITORING

#### 3.7.1 General

- a. One (1) steam flow meters shall be furnished by Energy Systems Group (ESG), and installed per Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS. The meter shall be located on the high pressure (120 psi) steam service serving the SSP. The UMCS shall continuously monitor steam flow through a separate analog output from the meter. The UMCS software shall totalize the steam flow. The UMCS shall use the following equation to calculate the energy usage:  $((\text{lb/hr}) \times (871))/1000 = \text{MBH}$ . The calculated value shall be displayed at the operator workstation.
- b. One (1) steam condensate flow meter shall be furnished by Energy Systems Group (ESG), and installed per Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS. The meter shall be located on the high pressure (120 psi) condensate return service. The UMCS shall continuously monitor condensate flow through a separate analog output from the flow meter. The UMCS software shall totalize both of the condensate flow.
- c. Pressure reducing valve (PRV) stations will be provided for the Project.
  - (1) High pressure-to-medium pressure (120-to-60 psi) stations, shall be provided with a parallel 1/3-2/3 control valve arrangement. Valves shall modulate in series, 1/3 valve shall open first, 2/3 valve shall open when 1/3 valve is fully open. These stations provide system redundancy and shall include an active station and standby station. Control of the active-standby stations shall be achieved via that station's dedicated pressure control programmable logic controller (PLC).
  - (2) Medium pressure-to-low pressure (60-to-15 psi) stations, shall be provided with a parallel 1/3-2/3-2/3 control valve arrangement. Valves shall modulate in series, 1/3 valve shall open first, 2/3 valve shall open when 1/3 valve is fully open. The second 2/3 control valve provides PRV station redundancy and shall be inactive until failure of the first 2/3 control valve. Control of the active-standby control valve shall be achieved via that station's dedicated pressure control programmable logic controller (PLC).
  - (3) Installation of the mechanical components associated with the PRV station shall be the responsibility of the mechanical contractor (refer to Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS); installation of the 120 vac wiring associated with the PRV station control panel shall be the responsibility of the electrical contractor (refer to Section 26 00 00 BASIC ELECTRICAL MATERIALS AND METHODS); and, installation of the controls and communication (i.e., Modbus and BACnet) wiring associated with the PRV station shall be the responsibility of the contractor.

## Repair Steam Sterilization Plant (SSP)

- d. The following sensors shall be furnished as part of each steam pressure reducing valve stations:
  - (1) Steam temperature upstream of PRV station.
  - (2) Steam pressure upstream of PRV station.
  - (3) Steam temperature downstream of PRV station.
  - (4) Steam pressure downstream of PRV station.
- e. For each pressure reducing station, the UMCS shall receive the upstream and downstream pressure and temperature readings and PRV station alarms via that station's pressure control programmable logic controller (PLC). This PLC shall provide a Modbus or BACnet communication signal, if Modbus communication is provide the data shall be transmitted to a Modbus-to-BACnet communication converter.

### 3.8 STEAM CONDENSATE RETURN UNITS (ELECTRIC)

- a. When any of condensate return units malfunction, condensate shall begin to rise within the unit. As the condensate overflows into the piping connected to the sanitary waste system, a dedicated self-acting temperature control valve, with its capillary sensor located downstream of the domestic water injection point in the overflow piping, shall monitor the condensate temperature. If it exceeds 140 degrees F, the self-acting control valve shall open to allow domestic cold water to mix prior to it dumping to the sanitary waste system.
- b. The condensate return unit shall be provided with a set of dry contacts which will open in the event a common trouble alarm exists. The contacts shall be monitored on the UMCS. The UMCS shall also monitor the condensate temperature and instantaneous flow.

### 3.9 FAN COIL UNIT CONTROL

- a. For mechanical, electrical and support spaces served by supplemental fan coil units, Refer to mechanical drawings for locations.
- b. In the event the space temperature is above setpoint, the UMCS shall command the FCU fan "ON" and modulate the normally closed chilled water coil control valve toward its open position to maintain the room temperature at its setpoint. Upon a decrease in space temperature below its setpoint, the reverse sequence shall occur. Once cooling coil control valve is fully closed, the FCU fan will be commanded "OFF" after a 5-minute time delay (adjustable).
- c. In the event the space temperature is below setpoint, the UMCS shall command the FCU fan "ON" and modulate the normally closed heating water coil control valve toward its open position to maintain the room temperature at its setpoint. Upon an increase in space temperature above its setpoint, the reverse sequence shall occur. Once heating coil control valve is fully closed, the FCU fan will be commanded "OFF" after a 5-minute time delay (adjustable).
- d. There shall be a minimum 4 degree deadband between heating and cooling setpoints.

### 3.10 LEAK DETECTION MONITORING

- a. Provide a complete microprocessor based cable type leak detection system to detect, alarm and locate the presents of water under and around the EDS equipment. The system shall include but not limited to a control panel, sensing cables, point sensors, jumper cables, graphic display map, and accessories.
- b. UMCS shall integrate to the Leak Detection system via BACnet. UMCS shall create floor plan graphics indicating location of leak detection cable and identify location of leak or fault during an alarm or trouble event.
- c. The system shall be capable of monitoring up to 5000 FT of sensing cable per zone and reporting the point of detection along the length of the cable to within 2 FT.
- d. Under normal conditions the system shall light a green status LED at the leak detection panel and send normal operation status to the UMCS.
- e. Upon detection of liquid, the system shall:
  - (1) Sound alarm at the leak detection control panel and generate an alarm at the UMCS.
  - (2) Light a red alarm LED at the leak detection control panel.
  - (3) Locally display at the leak detection control panel, to the nearest 2 feet, the location of the point of detection. UMCS to mimic display on operator workstation.
  - (4) If leak occurs with EDS spaces or around EDS equipment, activate dry contact alarm output relay for interlock shutdown of EDS equipment. Coordinate requirements with EDS vendor.
- f. Upon detection of an open or short in any system cabling, the system shall:
  - (1) Sound trouble at the leak detection control panel and generate an alarm at the UMCS.
  - (2) Light a yellow trouble LED at the leak detection control panel.
  - (3) Locally display at the leak detection control panel, to the nearest 2 feet, the location of the open or short. UMCS to mimic display on operator workstation.
  - (4) Activate dry contact trouble output relay.
- g. Alarm and trouble signals shall lock in until sensing cable is no longer wet or open in circuit is closed, and leak detection panel is manually reset.
  - (1) Audible alarm and trouble signal shall be silenceable (acknowledged) by activating a silence switch on the exterior of the control panel.

### 3.11 MISCELLANEOUS POINT MONITORING

The controls contractor shall provide the following monitoring points on the UMCS. The controls contractor shall provide all wiring, terminations, and field coordination necessary to successfully monitor the following points:

Description	Reference Doc.	Type	Qty(*)
Condensate inst. flow, device by Chevron		AI	1
Condensate Return Unit Com. Alm		DI	1
Condensate total flow, device by Chevron		DI	1
Water Softener common alarm		DI	1
Waste Water Lift Station General Alarm		DI	1
Waste Water Lift Station High Level Alarm		DI	1
Central UPS Low Battery Alarm		DI	2
Central UPS General Alarm		DI	2
Note: All 3rd party monitoring points with an asterisk (*) shall be commissioned by the commissioning agent.			

### 3.12 PLUMBING HEPA FILTER MONITORING

The UMCS shall monitor plumbing HEPA filters. Both the HEPA and the differential pressure switch shall be provided by Section 22 00 00 PLUMBING, GENERAL PURPOSE. The controls contractor shall provide 120VAC to each differential pressure switch. Refer to Plumbing drawings for quantities and locations.

-- End of Section --

SECTION 23 40 00.00 10

CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) AIR FILTRATION SYSTEM  
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D9.1M/D9.1 (2006) Sheet Metal Welding Code

ASME INTERNATIONAL (ASME)

ASME AG 1 (2003) Code on Nuclear Air and Gas Treatment

ASME BPVC SEC IX (2007) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME N509 (2002) Nuclear Power Plant Air-Cleaning Units and Components

**ASME N510 (2007) Testing of Nuclear Air - Treatment Systems**

ASME NQA-1 (2004; Addenda A 2005; Addenda B 2007) Quality Assurance Requirements for Nuclear Facility Applications

ASTM INTERNATIONAL (ASTM)

ASTM A 240/A 240M (2007e1) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A 740 (1998, R 2008) Standard Specification for Hardware Cloth (Woven or Welded Galvanized Steel Wire Fabric)

ASTM D 1056 (2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

U.S. DEPARTMENT OF ENERGY (DOE)

DOE HDBK-1169 (2003) Nuclear Air Cleaning Handbook

INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY (IEST)

IEST RP-CC-001.3

(1993) HEPA and ULPA Filters

UNDERWRITERS LABORATORIES (UL)

UL 586

(1996; Rev thru Aug 2004) Standard for High-Efficiency Particulate, Air Filter Units

UL 900

(2004; Rev thru Nov 2007) Standard for Air Filter Units

1.2 BID OPTION #14

- A. Provide separate pricing to upgrade HEPA Filter Housings as per Bid Option #14.
- B. The *option* to include #316 Grade Stainless Steel material for HEPA Filter housings indicated by Option #14, with exception of HEPA filter housings to the Class III biosafety cabinets (BSC).

1.3 COORDINATION OF TRADES

Ductwork, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.4 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

CBR Air Filtration System; G, AE  
Installation and Erection; G, AE

Drawings consisting of equipment layout including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports, typical support details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and pressure gage tubing layout showing the location of all gages. Drawings shall include table and/or schematic identifying outline or significant interface dimensions and any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-03 Product Data

Standard Products

Statement demonstrating successful completion of similar services on at least five projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section. Manufacturer's catalog data shall be included for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

1. Filtration System; G, AE
2. Filtration Elements; G, AE, including HEPA Filter, Gasket Seal, and Bag-In/Bag-Out Assembly and Banding Kits
3. Isolation Dampers; G, AE, and Damper Operators; G, AE
4. Pressure Gauge; G, AE
5. Manufacturer's Quality Assurance Program
6. Testing Agency Qualifications

Welding

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations. A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

Acceptance Tests

A copy of the test procedures, at least 2 weeks prior to testing.

Factory Tests

Proposed schedule for factory tests, at least 2 weeks prior to the start of related tests.

Field Training

Proposed schedule for field training, at least 2 weeks prior to the start of related field training.

SD-04 Samples

Filter Housing Samples; G, AE

*Provide sample of the first production of each of the filter housing configurations for inspection and approval. Housings are to be inspected at the factory. Features to be demonstrated include operation of the bubble tight dampers (both manually and automatic) decontamination, insertion of the spore test strips, filter change out and scanning of the filter media. The decontamination portion shall consist only of connection of dummy*

*hoses.*

*Sample is to be reviewed and approved after product shop drawings but before production of multiple units.*

*Samples shall be produced in groups so that a minimum of one and a maximum of two factory visits are required for inspection of all filter configurations.*

#### SD-06 Test Reports

##### Acceptance Tests

Certified test report for adsorbent filtration type. Test reports for filtration unit factory acceptance test, filtration unit field test, isolation damper acceptance test, air-aerosol mixing uniformity test, damper operation and leakage test, housing leak and pressure test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

#### SD-07 Certificates

##### Field Acceptance Tests

Testing agency certification prior to in-place filtration element testing.

##### Preparation for Shipping

Certification of compliance including a certified list of materials

#### SD-10 Operation and Maintenance Data

Filtration Unit Manuals; G, AR  
Operating and Maintenance Instructions; G, AR

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the Government for routine maintenance including the name of a local supplier, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4-hour on-site response to a service call on an emergency basis.

### 1.6 SYSTEM DESCRIPTION

The CBR Air Filtration System shall include ASTM A 240/A 240M Type 304 stainless steel side access housing with integral test section, isolation dampers located where indicated, HEPA filters, in-place test sections. The filtration system shall be provided with filtration element removal trays, removable access doors, filtration element banding kits, pressure ports, pressure gauges, duct transitions, test blanks, and other



appurtenances required for the specified operation. The filtration system shall have physical dimensions suitable to fit the space allotted. Sections of the filtration system shall be joined together in series to make a system that meets the required capacity. The filtration system shall be mechanically tested for leaks while in the factory. The filtration system shall be suitable for continuous operation with an air stream temperature of up to 135 degrees F. The system shall also meet the applicable requirements of ASME AG 1, ASME N509, **ASME N510**, and UL 586. Systems located in temperature controlled areas that filter conditioned air or low temperature ambient air shall be of double walled construction with thermal insulation in the interstitial space.

#### 1.7 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Each filtration element access door shall have a metal nameplate of the same material as the filter housing, fastened to the exterior which states the critical replacement components and part numbers for the equipment contained inside. The nameplate shall include filtration element model number, filtration element efficiency, and size. Each filtration element housing shall be provided with an external metal pocket, for holding the operation and maintenance instruction manual, which shall be provided with the housing. The instructions shall be complete and detailed for the actual filtration system provided.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

##### 2.1.1 General Requirements

- A. Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design, and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 5 years before bid opening. The 5-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 5 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 5-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 15,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.
- B. The HEPA containment filter assembly shall consist of the following sections and shall be supplied by one manufacturer as a complete and tested unit.
  1. High efficiency particulate air filters (HEPA).
  2. High efficiency side access housing with integral test section; including housing bag-in bag-out filter ring.
  3. In-place test sections before the HEPA for upstream injection and sampling of the challenge aerosol.

4. In-place section for insertion of biological test strips.
5. Transitions and plenums complete with turning baffles.
6. Bubble tight isolation dampers.
7. Specially designed Decontamination ports.
8. Mounting stands.
9. All components on supply air housings shall be double walled factory insulated with 1 inch thick insulation.

#### 2.1.2 Manufacturers

- A. Camfil Farr, Model GB.
- B. Flanders, Model CSC.

#### 2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

#### 2.3 HEPA FILTER / SCAN HOUSINGS

- A. All housings on supply air side shall be of 1 inch double wall construction and all housings on exhaust air side shall be single wall construction, fabricated of a minimum 11 and 14 gauge ASTM A 240/A 240M Type 304 stainless steel, with all pressure boundary joints, seams, and penetrations welded airtight. The housing shall conform to ASME N509. The housings shall be a single side servicing bank type arrangement. A housing two or more filtration elements wide shall be equipped with a filtration element removal rod. The housing design pressure shall be 20 inches wg for BSL-4 application and 10 inches wg. for (A)BSL-3E application. The housing shall be designed and constructed with specially designed decontamination ports, an integral structural steel frame and mounting stands. Lifting lugs with a minimum of 2 inch diameter eyeholes, made of the same material as the housing, shall be provided on the top of each filtration unit. All portions of the filtration system housing shall be free of sharp edges and burrs.
- B. The combination HEPA filter and in-place scan test housing shall be Bag-In/Bag-Out side access design and shall be designed to perform in-place scan testing of HEPA filters.
- C. The HEPA scan test housing shall be constructed of unpainted 11 and 14 gauge type 304 stainless steel. The HEPA scan test combination housing shall be adequately reinforced to withstand a negative or positive pressure of 20 in w.g. for BSL-4 application and 10 inches w.g. for (A)BSL-3E application. The design arrangement shall be a side-servicing bank that will allow air to enter and exit the housing without changing direction.
- D. To accommodate gasket seal filters; the housing shall incorporate a flat sealing surface that mates with the gasket on the face of the filter. Access to the filters shall be from the side of the housing. Prior to leaving the factory, each sealing surface shall be checked with a flatness gage to ensure proper mating with the filter. Each

tier of filters is fitted with a filter clamping mechanism. The filter clamping mechanism shall include independent pressure bars with pre-loaded springs that exert a minimum sealing force of 1400 lbs per full width filter and 1000 lbs per half width filter, applied as an even, uniformed load along at least 80 percent of the top and bottom of each filter frame. Brass pivot blocks in the locking mechanism are not acceptable.

- E. The scan test section shall incorporate a built-in Scan probe assembly. The probe assembly shall provide the ability to effectively scan the adjacent upstream filters in the system. Each HEPA filter shall be tested as specified by IEST RP-CC-001.3 for type C HEPA filters. The scan test section shall be engineered to provide access for full-face scan of HEPA filters.
- F. The scan assembly shall be positioned to allow the probe to make overlapping passes maximum of 1 inch from the filter face. The adjacent HEPA filter will have a downstream seal location to allow the scan probe to completely scan the full face of the filter and the filter seal area without obstruction.
- G. The scan test section probe assembly shall be engineered to provide isokinetic sampling at HEPA filter nominal capacity.
- H. The probe assembly shall be attached to an interior connection by flexible tubing. The interior connection shall penetrate the pressure boundary via pipe welded in-place, which in turn, joins to an exterior mounted 1/4 inch stainless steel ball valve with a brass plug. The ball valve functions as the exterior tube connection leading to the government's testing equipment. Each probe shall have its own corresponding penetration through the front of the housing allowing each filter to be tested simultaneously provided there is test equipment for each filter.
- I. All pressure retaining weld joints and seams shall be continuously welded with no pores allowed. Joints and seams requiring only intermittent welds, such as reinforcement members, shall not be continuously welded. As a minimum, joints and seams shall be wire brushed and/or buffed to remove heat discoloration, burrs and sharp edges. All weld joints and seams that are a portion of any gasket sealing surface (e.g., duct connecting flanges) shall be ground smooth and flush with the adjacent base metal.
- J. The upstream and downstream flanges shall have a 1.5 inch minimum flange width. Flanges shall be turned to the outside of the airstream to prevent contamination build-up and allow the customer to connect mating ductwork from outside the housing.
- K. All welding procedures, welders and welder operators shall be qualified in accordance with ASME BPVC SEC IX. All production welds shall be visually inspected, which incorporates the workmanship acceptance criteria described in sections 5 and 6 of ANSI/AWS D9.1M/D9.1, "Specifications for Welding Sheet Metal".
- L. All hardware on the HEPA scan test housing and all mechanical components shall be 300 series stainless steel, except for the polymer bushings, flexible tubing, and the cast aluminum door knobs.
- M. The HEPA scan test housing shall have a bagging ring around each

access port. The bagging rings shall have two (2) continuous ribs to secure the PVC filter change-out and scan bags. The outer edge of the ring shall be hemmed to prevent the PVC bag from tearing. Each access port and bagging ring shall be covered by a door having an extruded silicone gasket that is manually replaceable (if damaged) after the door has been removed. When closed, the door shall not press against the bag-out port and PVC bag, thus eliminating the possibility of the bag being cut by pressure from the door to the bag and bag-out port.

- N. The scan section PVC bag is 8 mil thick and clear at the mouth to allow the test technician visibility during testing. The scan section bags shall have two (2) yellow glove sleeves and one (1) clear sleeve built into the bag to allow for a flashlight to be used facilitate scanning the filter.
- O. All PVC bags of this design shall have been tested by an independent laboratory to prove the bag's operability at extreme temperature ranges of 0 degrees F to 130 degrees F (a test report verifying this test shall be furnished upon request). A 3/16 inch diameter elastic shock cord shall be hemmed into the mouth of the bag so that it fits securely when stretched around the bagging ring. To prevent the bag from sliding off the bagging ring during the operation, one (1) nylon security strap shall be provided with each filter access port. Additionally, one (1) nylon cinching strap shall be provided with each access port to tie off the slack in the PVC bag while the ventilation system is operating.
- P. The HEPA scan test combination housing shall be manufactured under a Quality Assurance Program that meets all the basic requirements of ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities". The manufacture shall submit documented evidence they have been independently audited by customers at least three (3) times within the last six (6) years to ASME NQA-1 requirements and successfully passed all three (3) audits. All components required in the final containment filtration system shall be completely fabricated, assembled, tested and cleaned at the manufacturer's facility.
- Q. The Scan housing shall be tested for operation of the probe assembly and leak tightness before leaving the factory.
- R. A minimum of 48 inch clearance in front of each access door on the HEPA scan test combination housing is suggested for filter replacement and scan testing.
- S. Manufacturer shall provide drawings of filter housing to be incorporated into coordination drawings for the Project.

#### 2.3.1 Filtration Element Access Door

Each filtration element location shall be provided with an access door to remove the filtration element and replace it with another. Access doors shall be double-wall insulated (supply air side only) type and fully gasketed to the filtration system housing. Each access door shall be rigid and provided with at least four tie-down latches with locking hasps and with tamper-proof fasteners. The access door shall be designed such that, when removed or opened, no sharp projections remain and access to the filters bag-out port is not impeded. When the access door is closed, it shall not press against the bag-out port or the PVC bag.

### 2.3.2 Filtration Element Sealing Mechanism

Filtration elements provided with gasket seals shall have a sealing mechanism that is a replaceable unit, constructed of series 300 stainless steel, providing a total clamping force of 1400 lbs per filtration element in accordance with DOE HDBK-1169.

### 2.3.3 Casings and Insulation

Casings shall be field insulated as specified in Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS, paragraph: Casings. For double wall type casing sections all of the required insulation shall be placed inside the cavity area.

## 2.4 FILTRATION ELEMENTS

Air filtration elements shall be listed in accordance with UL 900, except that high-efficiency particulate air filters shall meet the requirements indicated.

### 2.4.1 HEPA Absolute Package Filter 99.99 Percent Efficiency

- A. HEPA filters shall be 12 inch by 12 inch by 11.5 inch or 24 inch by 24 inch by 11.5 inch as required, factory scan tested to meet the leak-free scan requirements outlined in IEST RP-CC-001.3. The factory scan test shall be conducted at 250 fpm. Prior to scanning, each HEPA filter shall be penetration tested in accordance with IEST RP-CC-001.3, and shall be 99.99 percent minimum efficiency on 0.3-micron size and be certified. Glass scrim or 4 by 4 mesh galvanized wire fabric made from 23 gauge steel wire conforming to ASTM A 740 faceguards are required on both sides of the filter face.
- B. HEPA filters shall be UL 586 qualified and labeled.
- C. Frame shall be aluminum.
- D. Initial resistance at 250 fpm shall not exceed 1 in w.g.
- E. After factory testing and before packaging, a thin coat of silicone grease (General Electric G661 or equal) shall be applied to the entire face of each HEPA filter neoprene gasket.

### 2.4.2 Gasket Seal

An interlocking dovetailed gasket shall be mounted and sealed to the perimeter of the upstream face of the filtration element frame in accordance with ASME AG 1, Section FC. The gasket shall be oil resistant expanded cellular elastomer conforming to ASTM D 1056 Grade 2C2. The gasket shall be able to withstand the specified applied clamping force without loss of seal resilient memory.

## 2.5 BAG-IN/BAG-OUT ASSEMBLY AND BANDING KITS

Each filtration element access location shall be provided with a bag-in/bag-out assembly and 8 mil transparent PVC bag sized to completely enclose the element and suitable for 135 degrees F ambient environment. The assembly shall be located inside the access door. The bag shall have an elastic shock cord hemmed into its mouth and secured by a strap to the

assembly to prevent bag slippage during the filtration element bagging procedure. The bag shall be tested at the factory to ensure it has no leaks. An additional quantity of one complete set of spare bags shall also be provided and turned over to the Contracting Officer. One complete banding kit shall be provided with each filtration unit equipped with a bag-in/bag-out assembly. The banding kit shall provide a secure clamping off of the bag between the housing and the spent filtration element. Each kit shall contain a banding tool, a bag-cutting tool, and two sets of plastic ties, stainless steel bands, and replacement bags. Additional tools required to complete the bag-in/bag-out procedure shall also be provided.

## 2.6 IN-PLACE DOP/GAS AEROSOL TEST SECTION

The test sections shall be provided as an injection, sampling, and/or injection and sampling combination as indicated, constructed in a manner identical to the remainder of the filtration system housing and meet the applicable design parameters of ASME N509. Where a second stage of HEPA filters is required, an injection and sampling combination test section shall be used between the first and second stages. The test sections shall be constructed such that adjoining parallel test sections are isolated from each other. This shall permit individual efficiency and mechanical seal test of each HEPA filter and supporting framework in accordance with

**ASME N510.** The pressure drop across each test section shall be no greater than 0.25 inches wg at 1000 cfm during the test. Provide hinged (swing-away) baffle type test sections. Stationary baffle type test sections are not acceptable. The test section shall be furnished with swing-away mixing devices. Injection and sample ports and apparatus shall be provided to form an integral part of the test section.

## 2.7 IN-PLACE TEST PORT

Upstream challenge aerosol inlet and sample ports shall be provided for each HEPA filter section. The test port shall be a 1/2 inch NPT Type 304 stainless steel coupling with plug, used for upstream sampling, located upstream of the HEPA filter and welded to the top side of the filtration system housing. Three additional test ports shall be provided and shipped loose for field installation into the ductwork; one used for injection upstream, one used for sampling before the filter housing, and one used for downstream sampling of the filtration system housing. Upstream inlet and sample port and downstream sample port shall be located to provide uniform mixing during field-testing as required by ASME N509 and **ASME N510.**

## 2.8 ISOLATION DAMPERS

A. Isolation dampers shall be provided as an integral part of the filtration system. Dampers shall be classified, constructed, inspected, and tested in accordance with ASME N509 construction Class A as a single blade damper or a combination of single blade dampers. The leakage of the isolation dampers shall conform to ASME AG 1, Section DA, Class 0, zero leakage. The blade/disk, frame, shafts, and linkages shall be constructed of Type 304 stainless steel. The dampers shall have Type 304 stainless steel disk with a silicone gasket. The isolation damper disk gasket seal and shaft seal shall be replaceable. Automatic isolation damper shall be operated by an independent pneumatically-actuated drive mechanism with manual backup. Isolation dampers shall be of all welded design. Isolation damper flanges shall have factory drilled 7/16 inch holes, located on

the filtration unit as indicated and shall be no more than 4 inches apart as described in DOE HDBK-1169. The flanges shall be reinforced with flat stock of the same material to provide a combined minimum thickness of 1/4 inch.

- B. The dampers shall be a positive seal, isolation type. Damper housings shall be cylindrical and constructed of 11 gauge T-304 stainless steel. Silicone gasket shall be replaceable. The damper shall be all weld design. *Bubble Tight Dampers with automatic pneumatic actuators and manual operation shall be of the flat blade type.* The blade shall consist of two 3/16 inch thick type 304 stainless steel plates with a silicone gasket between them, to seat against the inside of the housing wall.
- C. All bubble tight isolation dampers and actuators shall be supplied by the HEPA Containment Filter Assembly manufacturer. Refer to Paragraph 1.8 "FACTORY TESTING" under subparagraph 1.8.1 "Bubble Tight Dampers" in Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS for factory testing requirement of bubble tight dampers.
- D. The actuator on each isolation damper that does not require a pneumatic actuation in the drawings shall be 1/4 turn geared manual actuator with handwheel. The actuator shall be constructed of cast iron and be weather-tight. Rated output torque shall be 4500 in lb with a gear ratio of 30:1. Actuator shall be fully lubricated and self-locking. Actuator shall be mounted outside of the air stream. Refer to drawings for actuator locations.
- E. Refer to the drawings for automatic isolation damper locations. The pneumatic actuator shall be a "fail-safe" quarter-turn rotary output air-to-spring type with external adjustable end stops, and operating air pressure of 80 psi. The actuator shall be fully lubricated and designed to operate in any position. Each actuator shall be supplied with mounting holes for attachment to a stainless steel mounting bracket. One adjustable flow control valve and a beacon type mechanical dial indicator. Refer to Division 25 for direction of spring, either "normally open" or "normally closed" operation. The actuator shall be equipped with a manual override hand wheel, a 1/2 inch solenoid valve for remote operation with override/test button, and digital output contacts to indicate both open and closed damper positions. The actuator assembly is to have an adjustable restrictor (bleed) valve that can be used to adjust the actuator closing rate. Actuator shall be mounted outside of the air stream.
- F. Dampers to be flanged for bolted and gasketed connection to ductwork.

#### 2.8.1 Pneumatically and Manually Actuated Isolation Damper Operators

Damper operators shall operate in an automatic mode with manual backup. The pneumatic/manual operator shall be of sufficient capacity to operate the damper under all conditions, and to guarantee tight close-off of the damper against all system pressures encountered. The maximum force required to manually actuate the damper shall be 25 pounds. Controls shall be as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

#### 2.9 DUCTWORK AND DUCT TRANSITIONS

- A. All ductwork and duct transitions shall be stainless steel and shall

be as specified in Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.

- B. The transitions shall be constructed of unpainted 304 stainless steel and designed with reinforcement to withstand a negative or positive working pressure of 20 in w.g. for BSL-4 application and 10 in w.g. for (A)BSL-3E application. Transitions shall be tapered as indicated on the drawings. The minimum acceptable sheet metal thickness shall be 12 gauge for 20 in w.g. pressure and minimum 16 gauge for 10 in w.g. pressure. They shall be attached to the filter system by continuous seal welding. The adjoining connection to the transition shall be a 1/4 inch plate flange.

## 2.10 THERMAL INSULATION

Thermal insulation for ductwork and equipment shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.11 PRESSURE GAUGE AND TEST PORTS

- A. Pressure gauges shall be furnished to read across the HEPA filter and system, and shall be factory installed by the filtration system manufacturer. Pressure gauges shall be dial type and diaphragm operated. Gauges shall be provided for monitoring HEPA filter banks and total filter system pressure drop. Gauges shall be at least 3-7/8 inches in diameter and shall have white dials with black figures with graduations.
- B. The HEPA filter gauge shall have a range of 0 to 6 inches w.g. The overall system gauge shall have a range of 0 to 10 inches w.g.
- C. Pressure gauge piped across the filter bank shall be provided with an integral pressure transmitter. The transmitter shall have a 4-20ma output and shall have an accuracy of plus/minus 2 percent FS. Each gauge shall incorporate a screw operated zero, span, and pointer zero adjustment and shall be furnished complete with stainless steel compression fittings and tubing.
- D. Pressure gauges piped across the system shall not be provided with an integral pressure transmitter. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with stainless steel compression fittings and tubing.
- E. All hardware shall be mounted in one location and tested at the factory. All gauges shall have a dual dial scale readout in units of pascals and inches water gauge.
- F. Static pressure taps shall be located on the unit upstream and downstream of each filter bank. The connections shall be 1/4 inch 300 series stainless steel half couplings.
- G. The tubing, fittings, and valves shall be 300 series stainless steel. The factory installed pressure gages shall be mounted in a 300 series stainless steel, heavy duty mounting brackets with 300 series stainless steel identification labels and an airflow direction label stitch welded to the mounting bracket.
- H. Gages shall be mounted in a stainless steel mounting bracket located on the system.



- I. The dirty side tubing line to each pressure gage shall be equipped with an in-line HEPA filter. Isolation ball valves shall be located on each side of the in-line HEPA filter. Additionally, a decontamination ball valve shall be located adjacent to the in-line HEPA filter. In-line HEPA filters shall be constructed of T-304 stainless steel and shall be individually tested to ensure a minimum efficiency of 99.99995 percent on 0.12 micron size particles. A valved by-pass shall connect the high and low side tubing for each gage to allow zeroing.
- J. Test Ports shall be installed as follows. An upstream sample port, 3/8 inch stainless steel half coupling with 300 series stainless steel hex plugs shall be welded to the door side of the housing for upstream sampling. Refer to drawing details.

#### 2.12 MISCELLANEOUS ACCESSORIES

- A. Lifting lugs shall be provided on the housing as required. They shall be 6mm thick 304 stainless steel with a 1.5 inch diameter lifting hole. All portions shall be free of sharp edges and burrs. Eight (8) lifting lugs are required on each double HEPA assembly, and six (6) on each single HEPA assembly.
- B. There shall be four (4) tie down latches per access door and they shall be manufactured in such a manner that they pivot away after they are released, therefore, the latches do not impede the filter change-out process. The latch shall be designed to provide both a retainer for the aluminum star knob and to eliminate the hazard of a sharp protruding object.
- C. The manufacturer shall provide a filter removal tray to support the filter that is being removed from the housing and replaced during the filter change-out procedure. The tray shall be fastened to the housing by means of the pivoting door latches following the removal of the door. The tray table and support frame shall be manufactured from 300 series stainless steel. Provide five (5) 10 inch by 12 inch and five (5) 24 inch by 24 inch sizes.

##### 2.12.1 Decontamination and Neutralization Ports

These ports shall be installed on each filter train as shown on the drawings and as compatible with the Certek formaldehyde generator / neutralizer. Each port consists of a reinforcement plate welded to the transition, 3 inch IPS Schedule 40, stainless steel pipe nipple, 3 inch IPS stainless steel pipe flange, 3 inch IPS butterfly valve and 3 inch IPS aluminum cam and groove hose connection with dust plug. The butterfly valve shall be wafer pattern, lever operated, and shall be bubble-tight at 150 psi. It shall have a cast iron body, aluminum bronze disc, stainless steel stem and EPDM seat.

##### 2.12.2 Mounting Stands

Each filter train shall be supported by a mounting stand constructed of minimum 2 inch square stainless steel tubing. Each leg of the mounting stand shall have a 6 inch by 6 inch by 1/4 inch stainless steel footing plate welded to the bottom. Each footing plate shall have two 1/2 inch diameter mounting holes. The mounting stands shall have gussets and cross members for adequate bracing and support. Legs shall have lockable screw

adjustment to allow up to 3/4 inch of vertical height adjustment on site.

### 2.12.3 Factory Assembly of Units

Each filter train, consisting of all the components specified herein, shall be factory assembled into complete assemblies as shown on the drawings. All pressure gauges shall be factory installed and shall be operable when the filtration systems are shipped from the factory. All filtration systems shall be supplied with lifting eyes for handling. Only HEPA filters shall be shipped separately.

## PART 3 EXECUTION

### 3.1 INSTALLATION AND ERECTION

CBR Air filtration systems shall be installed and erected in accordance with ASME N509, as indicated on the drawings, and in accordance with the manufacturer's diagrams and recommendations.

### 3.2 WELDING

Welding procedures, welders, and welding operators shall be qualified in accordance with ASME BPVC SEC IX. All welding performed shall meet the requirements specified in ASME BPVC SEC IX and as required by ASME N509. Pressure retaining weld joints shall comply with the requirements of ASME BPVC SEC IX.

### 3.3 FACTORY NUCLEAR QUALITY ASSURANCE PROGRAM

The filtration units and stand-alone isolation dampers shall be manufactured under a quality assurance program that meets the requirements stated in ASME NQA-1.

### 3.4 FACTORY STRUCTURAL DESIGN AND SEISMIC QUALIFICATION

The filtration system, components, and accessories shall be structurally designed and tested with appropriate documentation and certification as required by ASME AG 1 Section AA. The service condition of the filtration system shall meet level B service limits with the design loads indicated. The structural design of the filtration system, components, and accessories shall be verified by analysis, testing, or a combination of analysis and testing. The filtration system shall be subjected to 5 operating based earthquakes (OBE) and one safe shutdown earthquake (SSE) as indicated by the required response spectrum. Each OBE and SSE shall have a minimum test duration of 30 seconds. The filtration system, components, and accessories shall meet the seismic protection requirements specified in Section 01 41 50 CONTRACTOR QUALITY CONTROL and 23 05 48 VIBRATION AND SEISMIC CONTROLS FOR HVAC DUCTWORK, PIPING AND EQUIPMENT.

### 3.5 FACTORY ACCEPTANCE TESTS

All acceptance tests shall be in accordance with the procedures in **ASME AG 1, ASME N509, ASME N510, and UL 586 as required by contact specifications and as delineated in Article 1.6, System Description.** Proposed test schedules for adjusting and balancing, housing leak and pressure, air-aerosol mixing uniformity, damper operation and leakage, system bypass, and performance tests of systems, shall be provided at least 2 weeks prior to the start of related testing.

### 3.5.1 Visual Inspection

Visual inspection shall be performed in accordance with **ASME N510**.

### 3.5.2 Factory Housing Leak and Pressure Test

The filtration system housing shall be factory leak tested in accordance with **ASME N510**, Section 6, using the pressure decay method. The maximum housing leakage rate acceptance criteria shall be in accordance with DOE HDBK-1169 table 4.5, which is 0.05 percent of housing volume at 10 inches wg pressure differential. The housing shall be tested both positively and negatively to the design pressure of 20 inches wg for BSL-4 application and 10 inches w.g. for (A)BSL-3E application before performing the DOE HDBK-1169 housing leak acceptance criteria test.

### 3.5.3 Airflow Capacity and Distribution Test

The airflow across each filtration element bank shall be measured to verify that it meets the designed flow rate under actual field conditions. The test shall also verify that the airflow is distributed evenly across each filtration element bank as required by **ASME N510** which is +/- 20 percent of the average airflow through each filter bank. All tests shall be in accordance with **ASME N510**.

### 3.5.4 Air-Aerosol Mixing Uniformity Test

A challenge gas shall be introduced into the air system to verify that it has uniformly mixed before entering the filtration element bank. The test procedure shall follow and comply with **ASME N510**.

### 3.5.5 Damper Operation and Leakage Test

The damper shall be tested to verify that it operates as specified. The air leakage rate through the isolation dampers shall be measured and recorded. The damper shall be functionally tested as required in **ASME N510**. The leakage test method for Class 0 dampers shall be the pressure decay or bubble test method as specified in ASME AG 1 and **ASME N510**.

### 3.5.6 System Bypass Test (Filter Mounting Frame)

The filtration elements at each HEPA mounting frame housing location shall be removed and replaced with a test blank. The filtration element housing and housing seal shall be tested in accordance with **ASME N510**. The air that bypasses the test blank shall be measured and recorded as an air leakage rate, repaired by seal welding and retested. Caulking or other temporary sealing measures are not allowed. The acceptable leakage rate shall be zero percent. After testing is completed the blank shall be removed and the filtration elements reinstalled. The test blank shall then be turned over to the Contracting Officer.

## 3.6 PREPARATION FOR SHIPPING

The filtration system shall be mounted with protective shipping skids, crated or covered, blocked, braced, and cushioned as necessary to prevent physical damage during shipping.

## 3.7 FIELD ACCEPTANCE TEST

After installation the filtration system shall be field tested for leaks

using a mechanical test method. The system shall also be tested for leaks between the filter element and its housing. Testing shall occur after installation and shall be performed by an independent testing agency in accordance with **ASME N510**. The test agency shall be certified in accordance with ASME NQA-1 or have demonstrated previous experience with similar systems as approved by the Contracting Officer. The HEPA filter DOP aerosol penetration will be less than 0.03 percent.

### 3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of eight (8) hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions and the Filtration Unit Manuals.

-- End of Section --

SECTION 26 00 00

BASIC ELECTRICAL MATERIALS AND METHODS

07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 11, EQUIPMENT, and Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

- A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- B. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- C. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

#### 1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12.47 kV primary, three phase, three wire, 60 Hz, and 480/277 volts secondary, three phase, four wire. Final connections to the power distribution system at the eight (8) 12.47 kV feeder switches shall be made by the Contractor as directed by the Contracting Officer.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Continuous slot channel mounting structures; G, AE

##### SD-03 Product Data

Grounding System; G, AE

Continuous slot channel; G, AE

Describe grounding materials and continuous slot channel.

##### SD-06 Test Reports

Grounding System

Megger readings of grounding system.

Distribution Equipment

##### SD-07 Certificates

Grounding System

Certify that grounding system field tests and inspections specified have been performed and that work meets or exceeds specified requirements. Attach reports as specified.

#### 1.5.1 Additional Submittals Information

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

##### 1.5.1.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.1.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.5.1.3 Mock-ups

Provide products and installation as specified in this Section 26 00 00 and in other applicable Division 26 Sections for in-place mock-ups specified in Section 01 45 10.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2.1 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

A. Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
3. Safety precautions.
4. The procedure in the event of equipment failure.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

- B. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

#### 1.9 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

#### 1.10 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

#### 1.11 COORDINATION

Follow Section 01 45 10 CONTRACTOR QUALITY CONTROL.

- A. Carefully examine Drawings of other trades for equipment requiring electrical connection, and ascertain that electrical characteristics of equipment scheduled thereon matches the service available. If any discrepancies are noted, immediately refer to A/E for resolution. If characteristics are correct, ascertain method of connection, "rough-in" dimensions, correct plug and receptacle configurations, and other conditions. While A/E has made every effort to provide such information as is known at time of design, final data must be obtained from shop drawings before proceeding.
- B. The responsibility of this Section includes obtaining required electrical characteristics of all electrically driven equipment on this Project, whether furnished under Division 26, other specification sections, or directly by the Contracting Officer, and for the correction of all problems arising from failure to do so.
- C. Access Doors: Coordinate with Section 08 31 13 ACCESS DOORS. In general, arrange work so access doors are not required. Where electrical devices requiring access must be concealed in finished



construction, coordinate with other trades, and provide schedule showing size and location of each door.

#### 1.12 DESIGN MODIFICATIONS

- A. Electrical systems supply, control, and/or monitor systems specified elsewhere, and are based on specific manufacturer's data. Where any agreement or change is made to supply equipment of larger capacity or different electrical characteristics, provide electrical system required to effect such changes within the intent of the Contract Documents. For example, if HVAC system motor is allowed to change from 50 hp to 60 hp, provide combination motor starter and wiring to accommodate change at no additional cost.
- B. Inform Contracting Officer in writing of such changes.

### PART 2 PRODUCTS

#### 2.1 GROUNDING SYSTEM

##### 2.1.1 Standards

NFPA 70 (NEC) Article No. 250.

##### 2.1.2 Materials

Non-ferrous copper and its alloys; no aluminum.

##### 2.1.3 Ground Rods

3/4 inch by 10 feet copperweld.

##### 2.1.4 Grounding Conductors

Code gauge stranded copper wire, bare or with green insulation. No aluminum conductors.

##### 2.1.5 Ground Clamps and Connectors

Multiple bolt type. Clamps for pipe, lugs for flat surfaces, saddle clamp or compression type for wire.

##### 2.1.6 Conduit Ground Bushings

Galvanized malleable iron with screw pressure connector; insulated throat where required.

##### 2.1.7 Buried Splices

Thermoweld.

##### 2.1.8 Exposed Splices

Acceptable ground clamps and connectors.

##### 2.1.9 Connections to Building Steel Construction

Thermoweld.

## 2.2 SUPPORTING DEVICES

Provide devices, anchors and fasteners to support equipment and conduit loads. Include weight of wire in conduit when selecting product size and type.

### 2.2.1 Continuous Slot Channel

#### 2.2.1.1 Manufacturers

- A. B-Line.
- B. T&B Superstrut.
- C. Unistrut.

#### 2.2.1.2 Material

Formed steel, 1-5/8 inches by 12 gauge.

#### 2.2.1.3 Finish

Primer and baked enamel. Hot dip galvanized where shown.

#### 2.2.1.4 Accessories

Manufactured fittings as required, including spring-loaded nut and bolt assemblies.

#### 2.2.1.5 Other Types

As shown.

#### 2.2.1.6 Option

In lieu of slot channels, welded assemblies using prime painted steel angles or channels are approved.

## 2.3 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

## PART 3 EXECUTION

### 3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS .

### 3.2 INSTALLATION - GENERAL

- A. Install work mechanically and electrically correct, and in a neat, workmanlike manner. Make changes and reinstallation to work not approved.

## Repair Steam Sterilization Plant (SSP)

- B. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. Obtain instructions from manufacturers, and consider them part of these specifications.
- C. Where existing equipment, piping, conduit, ductwork, and similar materials require moving for installation of new work, remove these items as required, and restore them to original location and condition. Patching of fire-rated assemblies shall restore the fire-resistive rating of the fire-rated assembly.

### 3.3 GROUNDING SYSTEM

- A. Provide a complete grounding system in accordance with NFPA 70 (NEC) Article 250 and authorities having jurisdiction.
- B. Provide reliable, low impedance, metallic, ground path for short circuit currents so that circuit protective devices can operate quickly and effectively. Make ground path continuous from service entrance equipment, through distribution system, to each outlet and electrically operated device and enclosure in the Project.
- C. Provide a grounding conductor in each of the following conduits. Connect to grounding system at each end.
  - 1. Each feeder from each substation, to distribution panelboard, motor control center, branch panelboards and other equipment shown.
  - 2. Each feeder to a distribution transformer.
  - 3. Each branch circuit from branch panelboard to individual receptacle, motor, etc.
  - 4. Additional grounding conductors as shown.
- D. Use approved grounding connectors. Clean surfaces bright before installing. Touch up painted surfaces after installation.
- E. Size grounding conductors in accordance with NEC unless larger sizes are indicated. In general, use bare wire. Where insulated wire is required, use green color code.
- F. At substations, distribution panelboards, motor control centers, and similar equipment, connect to ground bus inside equipment enclosure. Ground metering, transformer neutral, transformer ground pad, grounding devices, and non-current carrying metal parts including frame of enclosure, conduit, grounding conductors, and the like. Provide grounding bushings on metallic conduit, and interconnect with ground wire to ground bus.
- G. At each floor step-down transformer, interconnect transformer neutral with grounding conductor of secondary circuit and with bonding conductor of transformer enclosure. Extend grounding conductor to connection with building structural steel. Ground to nearest steel building column.
- H. Ground frames of motors. Conduit system is approved if connection box is bolted to motor frame. In other instances, provide grounding bushing on conduit, and extend grounding conductor to a bolt on frame

of motor. Where motor is part of apparatus, such as an air handling unit, ground enclosure using connector furnished by manufacturer. Provide connector if none is furnished.

- I. Ground steel building columns where indicated. Provide ground rod adjacent to column, and attach No. 4/0 grounding conductor to web of column with thermoweld connector. Attach connector to column below level of floor slab.
- J. At convenience receptacles, extend ground wire from grounding screw of receptacle to grounding connector of box.
- K. Perform equipment ground measurement field testing at all distribution equipment.

### 3.4 SUPPORTING DEVICES

- A. Support material from building structural system in accordance with NFPA 70 (NEC). Do not support material from joist bridging, ductwork, piping, or conduit. Do not drill structural steel members.
- B. Where electrical equipment is mounted in suspended ceiling panels, provide support members to span between framing members of ceiling suspension system. Do not support electrical equipment from acoustical panels or other ceiling material; attach to suspension system only. Securely fasten support members to framing members.
- C. Do not support electrical outlet boxes, cables, or conduit from suspension wires of ceiling suspension system. Do not attach work in such manner as to prevent removal of ceiling panels.
- D. Where electrical outlet boxes, and other equipment are installed on ceiling suspension system, use independent support clips with threaded studs. Do not attach to suspension system except for alignment. Use clips that snap around suspension system and have provisions for independent support wire. Attach a suitable anchor in structure above ceiling. Suspend a minimum No. 12 support wire to engage each clip.
- E. Provide a separate individual support for every junction and pull box. Support boxes with acceptable clamps or threaded rod. Do not use individual wire supports connected into ceiling grid.
- F. Provide mounting structures for electrical equipment where required. Use continuous slot channel or fabricated assembly.
- G. Provide 1/4 inch spacers behind surface mounted cabinets of electrical equipment to permit circulation of air.
- H. Suspension Racks: Provide racks of continuous slot channel for parallel runs of conduit. Suspend on adjustable hangers.
- I. Use adjustable clevis hangers for individual runs of suspended conduit. Align suspended runs in horizontal plane for neat appearance.
- J. Use acceptable beam clamps for connection to structural steel.
- K. Use minimum 3/8 inch rod for vertical supports; no perforated strap.
- L. Determine locations of anchors, inserts, and supports. Maintain

locations during construction.

- M. Use supporting hardware suitable for purpose intended. Use expansion shields with machine screws at concrete or solid masonry; toggle bolts at hollow masonry; lag bolts at wood surfaces. Use approved methods for other conditions as required. Do not use wood, plastic or fiber plugs.
- N. Do not exceed manufacturer's load rating for mounting devices.
- O. In cast concrete, use box inserts which allow lateral adjustment of the threaded member for proper alignment. Use continuous box inserts where required.

- P. Use support systems adequate for weight of equipment, conduit, and wiring.

### 3.5 HOUSEKEEPING PADS

- A. Provide concrete pads for floor mounted electrical equipment not less than 4 inches thick and extending 4 inches beyond equipment outline.
- B. Use equipment manufacturer's setting templates for anchor bolt and tie locations.
- C. Roughen base slab before placing concrete, using pneumatic equipment to remove 1/2 to 1 inch of material.
- D. Place concrete and install wire mesh one inch below finished surface.
- E. Apply hand trowel finish as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.6 MISCELLANEOUS CONCRETE WORK

Provide other concrete work required for electrical construction.

### 3.7 CORROSION RESISTANT COATING

Apply two coats to metal conduit in direct contact with earth.

### 3.8 FIELD PAINTING

- A. Except as specified below, and under Electrical Identification, field painting required for electrical construction is specified under Section 09 90 00 PAINTS AND COATINGS.
- B. Paint boxes, covers, and conduit as specified under Electrical Identification.

### 3.9 DEMONSTRATION AND TRAINING

Follow Section 01 79 00 DEMONSTRATION AND TRAINING.

-- End of Section --

SECTION 26 08 00

APPARATUS INSPECTION AND TESTING

08/08, CHG 1: 02/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Acceptance tests and inspections; G, DO

SD-07 Certificates

Qualifications of organization, and lead engineering technician; G, DO

Acceptance test and inspections procedure; G, DO

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. No work required by this section of the specification shall be performed by a second tier subcontractor.

a. Submit name and qualifications of organization. Organization shall

have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA ATS.

- b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

#### 1.4.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

#### 1.4.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

#### 3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Contracting Officer shall be notified at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

- ] a. Section 26 11 16 SECONDARY UNIT SUBSTATIONS
- b. Section 26 11 13.00 20 PRIMARY UNIT SUBSTATION

- c. Section 26 36 23 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH
- d. Section 26 23 00 LOW VOLTAGE SWITCHGEAR
- e. Section 26 24 13 SWITCHBOARDS

### 3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion of acceptance tests and inspections.

### 3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization shall be present when equipment tested by the organization is initially energized and placed in service.

-- End of Section --



SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1 (2020) American National Standard for Electrical Rigid Steel Conduit (ERSC)

ANSI C80.3 (2020) American National Standard for Electrical Metallic Tubing (EMT)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM D709 (2017) Standard Specification for Laminated Thermosetting Materials

ASTM E814 (2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

IEEE C57.12.91 (2011) Standard Test Code for Dry-Type Distribution and Power Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

Repair Steam Sterilization Plant (SSP)

NEMA FB 1	(2014) Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA ST 20	(2014) Dry-Type Transformers for General Applications
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TP 1	(2002) Guide for Determining Energy Efficiency for Distribution Transformers
NEMA TP 3	(2000) Standard for the Labeling of Distribution Transformers
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)	
TIA-569	(2019e) Telecommunications Pathways and Spaces
UNDERWRITERS LABORATORIES (UL)	
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1479	(2015; Reprint May 2021) Fire Tests of Through-Penetration Firestops
UL 1561	(2011; Reprint Jun 2015) Dry-Type General Purpose and Power Transformers
UL 360	(2013; Reprint Aug 2021) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 44	(2018; Reprint May 2021) UL Standard for

Safety Thermoset-Insulated Wires and Cables

UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Sep 2021) UL Standard for Safety Attachment Plugs and Receptacles
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 506	(2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers
UL 514B	(2012; Reprint May 2020) Conduit, Tubing and Cable Fittings
UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Mar 2020) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 797	(2007; Reprint Mar 2021) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM applies to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Transformers; G, AE

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Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Wireways; G, AE

### SD-03 Product Data

Receptacles; G, AE

Circuit breakers; G, AE

Switches; G, AE

Transformers; G, AE

Enclosed circuit breakers; G, AE

Manual motor starters; G, AE

Submittals shall include performance and characteristic curves.

### SD-04 Samples

Outlet Boxes for High Containment

### SD-06 Test Reports

600-volt wiring test

Grounding system test

Transformer tests

Ground-fault receptacle test

Busway and busway switches

### SD-07 Certificates

Fuses

### SD-09 Manufacturer's Field Reports

Transformer factory tests

### SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G, AR

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein.

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### 1.5 QUALITY ASSURANCE

#### 1.5.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

#### 1.5.2 Regulatory Requirements

- A. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.
- B. In addition to NFPA 70, raceways for communications systems shall comply with TIA-569 which has more stringent requirements regarding the allowable number of bends between pull boxes and regarding the maximum distance between pullboxes than found in NFPA 70.

#### 1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

### 1.6 MAINTENANCE

#### 1.6.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

- A. Single line diagram of the "as-built" building electrical system.

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- B. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
- C. Manufacturers' operating and maintenance manuals on active electrical equipment.

### 1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### 1.8 SEISMIC REQUIREMENTS

Seismic details shall conform to Section 26 05 48.00 10, SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

### 2.2 CONDUIT AND FITTINGS

Shall conform to the following:

#### 2.2.1 Rigid Metallic Conduit (RMC)

- A. Standards: NFPA 70 (NEC) Article No. 344, UL 6.
- B. Rigid Steel Conduit: ANSI C80.1, Electrical Rigid Steel Conduit.
- C. Joints: Standard pipe thread with coupling; deliver with thread protector on conduit up to 2 inch.
- D. Minimum Size: 3/4 inch.

#### 2.2.2 HEAVY WALL PLASTIC NON-METALLIC CONDUIT (RNC)

- A. Standards: UL 651; NFPA 70 (NEC) Article No. 352 and NEMA TC 2.
- B. Material: Polyvinyl chloride (PVC), equal to Carlon "PV-DUIT" Schedule 40, 194 degrees F, manufactured from C2000 impact modified resin.
- C. Tensile Strength: 7000 psi at 73.4 degrees F.
- D. Flexural Strength: 11,000 psi.
- E. Compressive Strength: 8600 psi.
- F. Material shall sustain UL impact 600 foot pound test.
- G. Joints: Chemical bond, solvent cement.

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### H. Minimum Size:

1. Underground: 2 inch.

### 2.2.3 Intermediate Metal Conduit (IMC)

- A. Standards: NFPA 70 (NEC) Article No. 342; UL 1242, NEMA 80.6a, Electrical Intermediate Metal Conduit (EIMC).
- B. Material: Steel, intermediate wall thickness, hot dipped galvanized.
- C. Joints: Standard pipe thread with coupling, deliver with thread protector on conduit up to 2 inches.
- D. Minimum Size: 3/4 inch.

### 2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

- A. Standards: NFPA 70 (NEC) Article No. 358; UL 797, ANSI C80.3, Steel Electrical Metallic Tubing (EMT).
- B. Material: Steel, thin wall, electrogalvanized.
- C. Minimum Size: 3/4 inch.

### 2.2.5 Flexible Metal Conduit

- A. Standards: NFPA 70 (NEC) Article No. 348; UL.
- B. Material:
  1. Steel, hot dip galvanized (except at A/BSL-4).
  2. At A/BSL-4 provide stainless steel.
  3. For A/BSL-4 surface mount device connections shall be stainless steel.
- C. Minimum Size: 3/4 inch.

#### 2.2.5.1 Liquidtight Flexible Metal Conduit (LFMC)

- A. Standards: NFPA 70 (NEC) Article No. 350 UL 360.
- B. Material: Core-galvanized flexible steel conduit. Jacket, extruded PVC, gray or black.
- C. Minimum Size: 3/4 inch.

### 2.2.6 Cast Conduit Fittings

- A. Standard: NFPA 70 (NEC) Article No. 314; ANSI/NEMA FB 1, UL 514B.
- B. Description: Cast body with gasketed screw cover and threaded hubs.
- C. Material: Cast ferrous alloy, corrosion resistant finish for steel conduit, formed PVC for plastic conduit.
- D. Not Approved: Zinc alloy and similar soft metal die castings.

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### 2.2.6.1 Conduit Connectors/Couplings

- A. Standards: NFPA 70 (NEC) Article No. 314; UL.
- B. Connector Material for Metal Conduit: Pressed steel.
- C. Liquidtight threaded for rigid steel conduit and intermediate metal conduit. Compression type for EMT.
- D. Corrosion resistant finish.
- E. Insulated conduit throat where required.

### 2.3 EXPANSION FITTINGS

- A. Material and Finish: Same as rigid metal conduit.
- B. Description: Cast slip joint fitting for conduit, with flexible bonding conductor for continuity of ground through metallic conduit.

### 2.4 OUTLET BOXES

- A. Standards: NFPA 70 (NEC) Article No. 314; UL.
- B. Material: Pressed steel, zinc coated.
- C. Minimum Size, UON: 4-inch square or octagon; depth as required.
- D. Minimum Size for communications outlets: 4-11/16" square, 2-1/8" depth.
- E. Mud rings for communications outlets: 2-gang, typical, 1-gang for wall mounted telephones.
- F. Extension Rings: To suit various conditions.
- G. Hardware: Grounding screw and connectors as required by wiring method.
- H. Other Types: As required to suit conditions.

#### 2.4.1 Pull and Junction Boxes

- A. Standards: NFPA 70 (NEC) Article No. 314; ASTM A123/A123M; TIA-569, UL.
- B. Material: Galvanized steel, code gauge.
- C. Cover: Same material as box, screw on type, maximum size 300 square inches in one piece.

### 2.5 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

### 2.6 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to



site shall not be used.

#### 2.6.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper. All conductors shall be copper.

##### 2.6.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

##### 2.6.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

#### 2.6.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

##### A. 208/120 volt, three-phase

1. Phase A - black
2. Phase B - red
3. Phase C - blue

##### B. 480/277 volt, three-phase

1. Phase A - brown
2. Phase B - orange
3. Phase C - yellow

##### C. 120/240 volt, single phase: Black and red

#### 2.6.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C

insulation or better.

#### 2.6.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter;  
ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger  
diameter.

#### 2.6.5 Building Wire

- A. Standards: NFPA 70 (NEC) Article No. 310; UL.
- B. Conductor: Copper, solid for No. 12 AWG and smaller, stranded for No. 10 or larger.
- C. Insulation: 600 volts; Type THHN.
- D. Other Types: As indicated or required.

#### 2.6.6 Plenum Cable

- A. Applicability:
  - 1. Specified in appropriate specification Section.
  - 2. Acceptable to authorities having jurisdiction for application.
  - 3. Control equipment provided is UL listed and marked for power limited operation in accordance with NFPA 70 NEC Article 725.
  - 4. Cable is UL listed and labeled for plenum use; CL2P, CL3P, CMP.
- B. Standards: Installation methods and cable materials shall comply with appropriate NFPA 70 NEC Articles.
  - 1. Signal and Control Circuits: NFPA 70 NEC Article No. 725, Parts A and C.
  - 2. Communication Circuits: NFPA 70 NEC Article No. 800.
- C. Provide cable meeting performance requirements of manufacturers of related equipment.

#### 2.6.7 Terminal Blocks

- A. Standards: UL listed and in compliance with ANSI/NEMA ICS 4.
- B. Material: High impact resistant, molded phenolic plastic.
- C. Characteristics:
  - 1. Rating: 600V.
  - 2. Size to correspond to AWG wire size to be terminated.
  - 3. Dead back.
  - 4. Double row.

5. Either strip or modular in configuration.
6. Connector shall be either pressure plate or screw clamp type. No special connectors or solder shall be necessary to affix wire to terminal block. Do not use blocks using wire binding screw, solder, stud and nut, quick connect, wire wrap, or taper receptacle.

#### 2.6.8 Small Wire Connectors and Terminals

- A. Standards: NFPA 70 (NEC) Article No. 110; UL.
- B. Application: Conductors No. 10 and smaller, solid and stranded, copper conductors.
- C. Description:
  1. Twist-on solderless pressure connector, spiral metal spring in metal cup or crimped metal sleeve, plastic insulating cap with long flared skirt to cover insulated portion of conductor.
  2. Terminals shall be compression type with barrels to provide maximum conductor contact and tensile strength.

#### 2.6.9 Large Copper Conductor Connectors

- A. Standards: NFPA 70 (NEC) Article No. 110; UL.
- B. Application: Copper conductors No. 8 and larger, solid and stranded, wire and bus.
- C. Material: Copper alloy.
- D. Wire Connector: Long barrel compression type, attached with hydraulic die.
- E. Bus Connector: Compression type with multiple bolts, tin plated flat washer.
- F. Applied Insulation: Vinyl tape over insulating filler, heat or cold shrinkable sleeves, or pre-molded plastic enclosure to fit each specific combination of connector and conductors.

### 2.7 SWITCHES

#### 2.7.1 Toggle Switches

- A. Standards: NFPA (NEC) Article No. 404; NEMA; UL.
- B. Construction: Heavy duty, industrial specification grade, 20A at 120/277V, 2 hp at 240V, 1 hp at 120V.
- C. Type: Flush, quiet, AC, totally enclosed brush tumbler, toggle handle, single pole, 3-way and 4-way as shown.
- D. Modifications: Pilot light, key operation, interchangeable type as shown.
- E. Wiring Type: Back and side, for #10 AWG if required.

F. Other Types: As shown or specified.

#### 2.7.2 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

#### 2.7.3 Disconnect Switches

- A. Standards: UL; NEMA KS 1.
- B. Description: Metal enclosed heavy duty switch with quick-make, quick-break mechanism; horsepower rated where used on motor circuits; fused or unfused as indicated; Class RK1 or RK5 clips are required; NEMA 1 or 3R enclosure as required, with external operating handle.
- C. Accessories: Provisions for padlocks on handle; defeatable interlock to prevent opening cover unless switch is off; auxiliary contact to disconnect control wiring for motor circuits; solid neutral or ground bus where required.

#### 2.8 CURRENT LIMITING FUSES, 600 VOLTS AND BELOW

- A. Standards: NFPA 70 (NEC) Article No. 240; NEMA FU 1.
  - 1. Low-Peak: UL Class RK1 and Class L above 600 amps. Use Dual Element for motor circuits.
  - 2. Low-Peak: UL Class J when equipment cannot accommodate Class RK1 fuses.
- B. Description: Cartridge fuse with rejection feature.
- C. Current Rating: Size as shown.
- D. Voltage Rating: To match distribution system.
- E. Interruption Rating: 300,000 amperes RMS symmetrical.
- F. Application: All locations where fuses are required.

#### 2.9 RECEPTACLES

##### 2.9.1 Convenience Receptacles (Standard)

- A. Standards: NFPA 70 (NEC) Articles No. 406; Fed. Spec. W-C-596D as verified by UL and NEMA tests WD-1, 3.02 through 3.10 and UL tests UL 498.
- B. Type: Duplex, 2 pole, 3 wire, with U-slot ground.
- C. Constructions: Heavy duty, industrial specification grade.
- D. Contacts: 20 ampere, 125V, phosphor bronze, double wiping.
- E. Wiring Terminal Type: Back and side.
- F. Grounding Terminals: Green screw.

- G. Other Types: As shown or required to match plugs for equipment furnished by Government or other trades.

#### 2.9.2 Ground Fault Circuit Interrupter Receptacles

- A. Standard: NFPA 70 NEC Article No. 406; UL 943, Class A; ANSI CI-1975; NFPA 70; NEMA WD 1; UL 498; and ANSI C 73.
- B. Type: Heavy duty industrial specification grade, duplex, 125 VAC GFI with indicating LED light; 5ma trip threshold.
- C. Construction: Electronic circuit board with surge suppressor; indicating light; moisture resistant circuit interrupter; wire connectors; shall fit in standard box; with test switch.
- D. Contacts: 20 amperes, double wipe.

#### 2.9.3 Clock Hanger Receptacles

- A. Standard: NFPA 70 (NEC) Article No. 406; NEMA; UL.
- B. Type: Single, 2 pole, 3 wire, with U-slot ground.
- C. Constructions: Heavy duty, industrial specification grade.
- D. Contacts: 15 amperes, phosphor bronze.
- E. Cover Plate: Integral hook for clock, recess for male cap, finish to match device plates.

### 2.10 TRANSFORMERS

#### 2.10.1 Distribution Transformers

- B. Standards:
  - 1. UL 1561, Standard for Safety for Specialty Transformers.
  - 2. UL 506, Standard for Safety for Dry-Type General Purpose and Power Transformers.
  - 3. NEMA ST 20, Dry Type Transformers for General Applications.
  - 4. NEMA 250, Enclosures for Electrical Equipment (1000 V Max).
  - 5. NEMA TP 1 (Guide for Determining Energy Efficiency for Distribution Transformers).
  - 6. NEMA TP 3 (Standard for the Labeling of Distribution Transformers).
  - 7. ANSI/IEEE C57.12.91, Standard Test Code for Dry-Type Distribution and Power Transformers.
  - 8. Department of Energy 2016 Efficiency Standards: Low Voltage Distribution Transformers
- C. Description: Two winding, air cooled, ventilated dry type; NEMA 1 indoor copper windings, grain oriented, high permeability, silicon

steel with low hysteresis and eddy current losses, sheet steel enclosure, prime coated and finished gray outside; connection compartment at bottom; vibration isolation between mounting frame and core/coil assembly.

- D. KVA Rating: As shown.
- E. Primary Voltage: As shown.
- F. Secondary Voltage: As shown.
- G. K-rating: K-13.
- H. Insulation: 220 degrees C.
- I. Sound Level: NEMA ST-20 or lower.
- J. Taps from Rated Voltage: For 30 KVA and above: 2 and 2.5 percent above and 4 at 2.5 percent below. For 15 KVA and below: 2 and 2.5 percent below and 2 at 2.5 percent above.
- K. Temperature Rise: 80 degrees C.
- L. Impedance: Between 3 percent and 5 percent.
- M. Accessories and Modifications: As shown.

#### 2.11 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 2.12 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

#### 2.13 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING.

#### 2.14 COMMUNICATIONS PATHWAYS FIRESTOPPING ASSEMBLIES

- A. Standards: UL 1479, ASTM E814.
- B. Description: Self-adjusting assembly for firestopping cable penetrations through rated walls and floors without the need for putties, bags, sleeves, etc. which must be removed and replaced for changes in the cable plant.

- C. Fire Rating: 1 hour and two hour as noted on architectural plans.
- D. Size: Cross-sectional area as noted on plans. Note that 23 sq. in. of each assembly is intended for Cat. 6 cables. If the UL listing of the assemblies limit the capacity of the assembly to carry Cat. 6 cables below what could be carried in 23 sq. in., the size of the assembly shall be increased to carry the number of Cat. 6 cables that could be carried in a 23 sq. in. area.
- E. Accessories and Modifications: Mounting frames.

## 2.15 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

## 2.16 SOURCE QUALITY CONTROL

### 2.16.1 Transformer Factory Tests

Submittal shall include routine NEMA ST 20 transformer test results on each transformer and also contain the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

#### 3.1.1 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC or EMT, except where specifically indicated or specified otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted. Minimum conduit size shall be 3/4 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07 84 00, FIRESTOPPING.

### 3.1.1.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

### 3.1.2 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Plan conduit runs for communications cabling so that the maximum cable length is under 295 feet, unless otherwise noted.

#### 3.1.2.1 Restrictions Applicable to EMT

- A. Do not install underground.
- B. Do not encase in concrete, mortar, grout, or other cementitious materials.
- C. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- D. Do not use in hazardous areas.
- E. Do not use outdoors.
- F. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

#### 3.1.2.2 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.

#### 3.1.2.3 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts.



Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

#### 3.1.2.4 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. UON. Cast-metal fittings shall not be permitted for conduit runs for communications cables. Conduits for communications cables shall have no more than two 90 degree bends between pull boxes. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

#### 3.1.2.5 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

#### 3.1.2.6 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for equipment subject to vibration, and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 3/4 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration or motors. Provide separate ground conductor across flexible connections.

#### 3.1.3 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces. Boxes in other locations shall be sheet steel., except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily

removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel. All accessible boxes shall be labeled. Branch circuit and power source panelboard shall be identified.

#### 3.1.3.1 Boxes

Boxes for use with raceway systems shall be minimum 1-1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Boxes for telecommunications outlets shall be a minimum of 4-11/16 inches square by 2-1/8 inches deep, unless otherwise noted. Mount outlet boxes flush in finished walls.

#### 3.1.3.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

#### 3.1.4 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet. Measure mounting heights of receptacle outlet boxes in the hazardous area to the bottom of the outlet box.

#### 3.1.5 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

##### 3.1.5.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets

of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

#### 3.1.6 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

#### 3.1.7 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

#### 3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00, FIRESTOPPING.

#### 3.1.9 Grounding and Bonding

Provide In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

##### 3.1.9.1 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermic weld.

- A. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up"

or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

- B. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

#### 3.1.9.2 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment.

#### 3.1.9.3 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

#### 3.1.10 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

#### 3.1.11 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

### 3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

### 3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00, PAINTS AND COATINGS. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and

apply in accordance to manufacturer's instructions.

### 3.4 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

#### 3.4.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

#### 3.4.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

#### 3.4.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm. Perform NETA visual and mechanical inspection.

#### 3.4.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a GFI injection-style tester.

### 3.5 DEMONSTRATION AND TRAINING

Follow Section 01 79 00 DEMONSTRATION AND TRAINING.

-- End of Section --

SECTION 26 28 01.00 10

COORDINATED POWER SYSTEM PROTECTION  
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 242 (2001; Errata 2003) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - Buff Book

IEEE 399 (1997) Brown Book IEEE Recommended Practice for Power Systems Analysis

IEEE 1584 (2018) IEEE Guide for Arc Flash Hazard Calculations

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1 (2002) Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures

NEMA FU 1 (2012) Low Voltage Cartridge Fuses

NEMA SG 6 (2000) Power Switching Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

NFPA 70E (2021) Standard for Electrical Safety in the Workplace

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

UNDERWRITERS LABORATORIES (UL)

UL 486E	(2019) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 1203	(2013; Reprint Apr 2022) UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fault Current Analysis; G, AE  
Protective Device Coordination Study; G, AE

The study along with protective device equipment submittals. No time extensions or similar contact modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed will be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Equipment; G, AE

Data consisting of manufacturer's time-current characteristic curves for individual protective devices, recommended settings of adjustable protective devices, and recommended ratings of non-adjustable protective devices.

System Coordinator; G, AE

Verification of experience and license number, of a registered Professional Engineer with at least 3 years of current experience in the design of coordinated power system protection. Experience data shall include at least five references for work of a magnitude comparable to this contract, including points of contact, addresses and telephone numbers. This engineer must perform items required by this section to be performed by a registered Professional Engineer.

Protective Relays; G, AE

Data shall including calibration and testing procedures and instructions pertaining to the frequency of calibration, inspection, adjustment, cleaning, and lubrication.

Installation; G, AE

Procedures including diagrams, instructions, and precautions required to properly install, adjust, calibrate, and test the devices and equipment.

#### SD-06 Test Reports

##### Field Testing

The proposed test plan, prior to field tests. Plan shall consist of complete field test procedure including tests to be performed, test equipment required, and tolerance limits, including complete testing and verification of the ground fault protection equipment, where used. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

#### SD-07 Certificates

##### Devices and Equipment

Certificates certifying that all devices or equipment meet the requirements of the contract documents.

### 1.3 SYSTEM DESCRIPTION

Provide organized time-current analysis of each protective device in series from main circuit breaker in branch circuit panelboard to CUP 12.47 kV feeder switches utilizing CUP available short circuit current and X/R for each feeder.

### 1.4 QUALIFICATIONS

#### 1.4.1 System Coordinator

System coordination, recommended ratings and settings of protective devices, and design analysis shall be accomplished by a registered professional electrical power engineer with a minimum of 3 years of current experience in the coordination of electrical power systems.

#### 1.4.2 System Installer

Calibration, testing, adjustment, and placing into service of the protective devices shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience in protective devices.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced.



## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCT

Protective devices and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory utility type use for at least two years prior to bid opening.

### 2.2 NAMEPLATES

Nameplates shall be provided to identify all protective devices and equipment. Nameplate information shall be in accordance with NEMA AB 1 or NEMA SG 6 as applicable.

### 2.3 LOW-VOLTAGE FUSES

#### 2.3.1 General

Low-voltage fuses shall conform to NEMA FU 1. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics requires for effective power system coordination.

#### 2.3.2 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject Class H fuses.

### 2.4 MOLDED-CASE CIRCUIT BREAKERS

#### 2.4.1 General

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers and circuit breaker enclosures located in hazardous (classified) areas shall conform to UL 1203.

#### 2.4.2 Construction

Molded-case circuit breakers shall be assembled as an integral unit in a supporting and enclosing housing of glass reinforced insulating material providing high dielectric strength. Circuit breakers shall be suitable for mounting and operating in any position. Lugs shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding

the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

#### 2.4.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

#### 2.4.4 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 150 amperes.

#### 2.4.5 Solid-State Trip Elements

Solid-state circuit breakers shall be provided as shown. All electronics shall be self-contained and require no external relaying, power supply, or accessories. Printed circuit cards shall be treated to resist moisture absorption, fungus growth, and signal leakage. All electronics shall be housed in an enclosure which provides protection against arcs, magnetic interference, dust, and other contaminants. Solid-state sensing shall measure true RMS current with error less than one percent on systems with distortions through the 13th harmonic. Peak or average actuating devices are not acceptable. Current sensors shall be toroidal construction, encased in a plastic housing filled with epoxy to protect against damage and moisture and shall be integrally mounted on the breaker. Where indicated on the drawings, circuit breaker frames shall be rated for 100 percent continuous duty. Circuit breakers shall have tripping features as shown on the drawings and as described below:

- a. Long-time current pick-up, adjustable from 50 percent to 100 percent of continuous current rating.
- b. Fixed long-time delay.
- c. Short-time current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- d. Fixed short-time delay.
- e. Short-time  $I^2$  square times  $t$  switch.
- f. Instantaneous current pick-up, adjustable from 1.5 to 9 times long-time current setting.
- g. Ground-fault pick-up, adjustable from 20 percent to 60 percent of sensor rating, but in no case greater than 1200 amperes. Sensing of

ground-fault current at the main bonding jumper or ground strap shall not be permitted.

- h. Fixed ground-fault delay.
- i. Ground-fault I square times t switch.
- j. Overload and Short-circuit and Ground-fault trip indicators shall be provided.

#### 2.4.6 SWD Circuit Breakers

Circuit breakers rated 15 amperes or 20 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

### 2.5 COORDINATED POWER SYSTEM PROTECTION STUDY

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last 3 years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers.

#### 2.5.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the source bus at this cup and extend through outgoing medium voltage feeders, through the secondary side of transformers for substations extend through the downstream devices at the load end.

#### 2.5.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the CUP for fault current availability at the site.

#### 2.5.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Location of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

#### 2.5.4 Coordination and Short Circuit Study

##### 2.5.4.1 Method

The coordination and short circuit study shall be performed in accordance with methods described in IEEE 242, and IEEE 399. Provide engineered coordination study by qualified engineers of switchgear equipment manufacturer for maximum selectivity of electrical overcurrent devices to

ensure proper equipment and personnel protection. Submit curves and study for review. Provide distances and pertinent information required.

#### 2.5.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedance shall be those proposed. Data shall be documented in the report.

#### 2.5.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

#### 2.5.4.4 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. A written narrative shall be provided describing: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost damages (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

#### 2.5.4.5 Study report

- a. The Contractor shall have the study prepared by qualified Registered Professional Electrical Engineer (licensed in the State of Maryland who has at least ten (10) years of experience and specializes in performing power system studies.
- b. The study shall be calculated by means of the SKM PowerTools for Windows (Design Standard) or equal computer software package. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
- c. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
- d. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
- e. The report shall document data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings.

- f. The report shall contain fully coordinated composite time-current characteristics curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form, from main circuit breakers in branch circuit panelboards back to cup 15RV service switchgear devices protecting service.
- g. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized.

#### 2.5.5 Arc Flash Hazard Study

- a. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the single line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one line drawing. This includes substations, switchgear, MCC's, distribution panelboards, branch circuit panelboards, UPS, ATS's, and transformers. The study will include creation of Arc Flash Hazard Warning Labels. These labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors. The electrical contractor shall install the labels.
- b. The arc flash hazard study shall consider operation during normal conditions, alternate operations, emergency power conditions, and any other operations that could result in maximum arc flash hazard.
- c. The Contractor shall have the study prepared by qualified Registered Professional Electrical Engineer (licensed in the State of Maryland who has at least ten (10) years of experience and specializes in performing power system studies.
- d. The study shall be calculated by means of the SKM PowerTools for Windows (Design Standard) or equal computer software package. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study. No substitutions will be acceptable.
- e. Perform the arc flash hazard study after the short circuit and protective device coordination study has been completed.
- f. The study shall be in accordance with applicable NFPA 70E, 29 CFR 1910 Sub-part S and IEEE 1584 Standards.
- g. Determine the following:
  - 1. Flash Hazard Protection Boundary;
  - 2. Limited Approach Boundary;
  - 3. Restricted Boundary;
  - 4. Prohibited Boundary;
  - 5. Incident Energy Level;
  - 6. Required Personal Protective Equipment Class;
  - 7. Type of Fire Rated Clothing.
- h. Produce an Arc Flash Warning label listing items 1-7 above. Also include the bus name and voltage. Labels shall be printed in color

and be printed on adhesive backed Avery labels.

- i. Produce Bus Detail sheets that lists the items G 1-7 from above and the following additional items.
  1. Bus Name;
  2. Upstream Protective Device Name, Type, and Settings;
  3. Bus Line to Line Voltage.
- j. Produce Arc Flash Evaluation Summary Sheet listing the following additional items:
  1. Bus Name;
  2. Upstream Protective Device Name, Type, and Settings;
  3. Bus Line to Line Voltage;
  4. Bus Bolted Fault;
  5. Protective Device Bolted Fault Current;
  6. Arcing Fault Current;
  7. Protective Device Trip / Delay Time;
  8. Breaker Opening Time;
  9. Solidly Grounded Column;
  10. Equipment Type;
  11. Gap.
  12. Arc Flash Boundary;
  13. Working Distance;
  14. Incident Energy;
  15. Required Protective Fire Rated Clothing Type and Class.
- k. The contractor shall submit the arc flash hazard study and arc flash warning labels at least 30 days prior to energizing the electrical equipment.
- l. Submit three (3) copies of the arc flash hazard study and (1) set of warning labels.
- m. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels. Proposed major corrective modifications will be taken under advisement by the Engineer, and the Contractor will be given further instructions.
- n. The results of the power system study shall be summarized in a final report. The report shall include the following sections:
  1. Introduction, executive summary and recommendations, assumptions, reduced copy of the one line drawing.
  2. Arc Flash Evaluations Summary Spreadsheet.
  3. Bus Detail Sheets.
  4. Arc Flash Hazard Warning Labels printed in color on adhesive backed labels.

### PART 3 EXECUTION

#### 3.1 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### 3.2 INSTALLATION

Protective devices shall be installed in accordance with the manufacturer's published instructions and in accordance with the requirements of NFPA 70 and IEEE C2.

### 3.3 FIELD TESTING

#### 3.3.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

#### 3.3.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

#### 3.3.3 Molded-Case Circuit Breakers

Circuit breakers shall be visually inspected, operated manually, and connections checked for tightness. Current ratings shall be verified and adjustable settings incorporated in accordance with the coordination study.

#### 3.3.4 Protective Relays

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. Tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to ensure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate.

#### 3.3.5 Demonstration and Training

Follow Section 01 79 00 DEMONSTRATION AND TRAINING.

-- End of Section --

SECTION 26 29 23

VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 3.1 (2019) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA ICS 7 (2020) Adjustable-Speed Drives

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-461 (2015; Rev G) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15 Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 489 (2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures



UL 61800-5-1

(2016) Adjustable Speed Electrical Power  
Drive Systems - Part 5-1: Safety  
Requirements - Electrical, Thermal and  
Energy

## 1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

## 1.3 SYSTEM DESCRIPTION

### 1.3.1 Performance Requirements

#### 1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

#### 1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

### 1.3.2 Electrical Requirements

#### 1.3.2.1 Power Line Surge Protection

IEEE C62.41, IEEE Std 519 Control panel shall have surge protection, included within the panel to protect the unit from damaging transient voltage surges. Surge arrestor shall be mounted near the incoming power source and properly wired to all three phases and ground. Fuses shall not be used for surge protection.

#### 1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Schematic diagrams; G, AE

Interconnecting diagrams; G, AE

Installation drawings; G, AE

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

#### SD-03 Product Data

Variable frequency drives; G, AE

Wires and cables; G, AE

Equipment schedule; G, AE

Include data indicating compatibility with motors being driven.

#### SD-06 Test Reports

VFD Test

Performance Verification Tests

Endurance Test

#### SD-08 Manufacturer's Instructions

Installation instructions

#### SD-09 Manufacturer's Field Reports

VFD Factory Test Plan; G, AE

Factory test results

#### SD-10 Operation and Maintenance Data

Variable frequency drives, Data Package 4; G, AR

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

### 1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

### 1.5.3 Installation Drawings

Show floor plan of each site, with VFDs and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

### 1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

### 1.5.5 Installation Instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

### 1.5.6 Factory Test Results

Document test results and submit to government within 7 working days after completion of test.

## 1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## 1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year, or the contracted period of any extended warrantee agreed upon by the contractor and the Government, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

## 1.8 MAINTENANCE

### 1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

### 1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

## PART 2 PRODUCTS

### 2.1 VARIABLE FREQUENCY DRIVES (VFD)

Design Type: Pulse Width Modulation, 6-pulse for up to 50HP, and 12-pulse for 60HP and above.

#### 2.1.1 Functions, Features and Ratings

Provide frequency drive to control the speed of induction motor(s). The VFD shall include the following minimum functions, features and ratings.

- a. Input circuit breaker per UL 489 with a minimum of 65,000 amps symmetrical interrupting capacity and door interlocked external operator.
- b. A converter stage per UL 61800-5-1 shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.
- c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform.
- d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.
- e. The VFD shall be designed to operate from a 460 volt, plus or minus 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating.

- f. Acceleration and deceleration time shall be independently adjustable from one second to 60 seconds.
- g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.
- h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.
- i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.
- j. The controller efficiency at any speed shall not be less than 96 percent.
- k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.
- l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:
  - 1. Short circuit at controller output.
  - 2. Ground fault at controller output.
  - 3. Open circuit at controller output.
  - 4. Input undervoltage.
  - 5. Input overvoltage.
  - 6. Loss of input phase.
  - 7. AC line switching transients.
  - 8. Instantaneous overload.
  - 9. Sustained overload exceeding 115 percent of controller rated current.
  - 10. Over temperature.
  - 11. Phase reversal.
- m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold

continuously for the timing period, the controller will automatically shut down.

- n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within plus or minus 0.5 percent of maximum speed without the necessity of a tachometer generator.
- o. The VFD shall be factory set for automatic restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be set for automatic restart after motor comes to rest before restart.
- p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.
- q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.
- r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:
  - 1. Manual speed potentiometer.
  - 2. Hand-Off-Auto ( HOA ) switch with auxiliary contacts. Contacts to open when the HOA switch is indexed out of the "auto" position.
  - 3. Power on light.
  - 4. Drive run power light.
  - 5. Local display.
- s. Line reactors.
- t. Load reactors on 250 horsepower and greater applications.
- u. Line filters in accordance with FCC regulations on RFI/EMI emissions for Class A devices.
- v. Line noise created shall not be greater than 3 percent total harmonic distortion, and no more than 16,400 volt microsecond communication notch area, in accordance with IEEE Std 519 (current issue) for special applications. Full harmonic study should be submitted for approval.
- w. Factory wired manual bypass with magnetic contactors and switch.
- x. Phase loss protection, over frequency protection, AC input line under voltage protection, DC over voltage protection, short circuit protection, ground protection, line surge protection, over temperature protection.
- y. Status and Fault Indicator Display.
- z. Motor overload relays.

- aa. Critical frequency avoidance capability.
- bb. Copper compression lugs for power terminations. T&B 54,000.
- cc. Contacts wired to shut down unit on signal from remote disconnect.

#### 2.1.2 Building Management System (BMS) Interface

- a. Coordinate with Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC to provide isolated and non-isolated I/O points.
- b. Provide an independent current sensing transmitter for monitoring run status. Transmitter shall provide a linear 4-20 ma output with a voltage and amperage rating greater than its connected load. Current sensing transmitters shall be of split-core design. The transmitter shall be rated for operation at 200 percent of the connected load. Voltage isolation shall be a minimum of 600 volts.
- c. Provide a network interface card which can communicate to the BMS via an RS-485 communication trunk. The card shall be able to communicate: BACnet MS/TP, LON, or the BMS manufacturer's proprietary protocol. The protocol shall be coordinated with BMS contractor prior to purchasing the VFDs. All software points within the VFD shall be visible to the BMS for monitoring. At a minimum the following points shall be available to monitor via the communication card:
  - 1. KWH output
  - 2. HOA switch out of "auto" position
  - 3. Drive fault
  - 4. Speed Feedback
- d. (FOR FAN SYSTEMS ONLY) Provide a separate terminal block for connecting the VFD to external safeties, external interlocks, and the BMS as described herein.
  - 1. Provide two terminals for remote enable and disable commands from the BMS.
  - 2. Provide two terminals for the following external safeties: high static pressure and low suction pressure. The safeties shall disable the drive regardless of the HOA switch position.
  - 3. Provide two terminals for the following external safety: freeze protection. The safety shall disable the drive regardless of the HOA switch position.
  - 4. Provide two terminals for smoke detection shutdown. The safety shall disable the drive regardless of the HOA switch position. A factory jumper shall be provided across these terminals, which can be removed in the field if required.
  - 5. Provide two terminals which are internally wired to the aux contacts of the motor "run" coil. Whenever the motor is energized the contacts shall close.
  - 6. Provide two terminals for external auxiliary equipment coupling. Upon the contacts opening, the drive shall be disabled regardless of the HOA switch position. A factory jumper shall be provided

across these terminals, which can be removed in the field if required.

7. Provide two terminals which will accept the remote speed signal. The drive shall accommodate 0-10vdc or 4-20ma speed signals.
8. Provide two terminals for outside air isolation damper interlock. The VFD shall close the contacts once the VFD is enabled via the HOA switch or BMS. The contacts shall be rated to handle a 120vac solenoid valve at 20VA.
9. Provide two terminals for monitoring the outside air isolation damper limit switch. The VFD shall not energize the fan until the limit switch contacts close, indicating the outside air isolation damper is open.

## 2.2 ENCLOSURES

Provide equipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

## 2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70NFPA 70.

## 2.4 SOURCE QUALITY CONTROL

### 2.4.1 VFD Factory Test Plan

To ensure quality, each VFD shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring.

### 3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

#### 3.2.1 VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at



least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

### 3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

### 3.2.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness level of 0.9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.

## 3.3 DEMONSTRATION

### 3.3.1 Training

Coordinate training requirements with the Contracting Officer.

#### 3.3.1.1 Instructions to Government Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

#### 3.3.1.2 Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place

mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

- a. System overview.
- b. General theory of operation.
- c. System operation.
- d. Alarm formats.
- e. Failure recovery procedures.
- f. Troubleshooting.

#### 3.3.1.3 Demonstration and Training

Follow Section 01 79 00 DEMONSTRATION AND TRAINING.

-- End of Section --

SECTION 26 36 00.00 10

AUTOMATIC TRANSFER SWITCH AND BY-PASS/ISOLATION SWITCH  
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.13 (2015) Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures

IEEE C37.90.1 (2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

IEEE 602 (2007) Recommended Practice for Electric Systems in Health Care Facilities - White Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 4 (2015) Application Guideline for Terminal Blocks

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA ICS 10 Part 2 (2020) Industrial Control and Systems, Part 2: Static AC Transfer Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 110 (2022) Standard for Emergency and Standby

Power Systems

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022)  
National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1008 (2014) Transfer Switch Equipment

UL 1066 (2012; Reprint Mar 2017) UL Standard for Safety Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, AE

Schematic, external connection, one-line schematic and wiring diagram of each ATS assembly.

Equipment; G, AE

Dimensioned plans, sections and elevations showing minimum clearances, weights, and conduit entry provisions for each ATS.

SD-03 Product Data

Material; G, AE

Equipment; G, AE

List of proposed equipment and material, containing a description of each separate item.

SD-06 Test Reports

Testing

A description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 4 weeks prior to test date. Certified factory and field test reports, within 14 days following completion of tests. Reports shall be certified and dated and shall demonstrate that tests were successfully completed prior to shipment of equipment.

SD-07 Certificates

## Repair Steam Sterilization Plant (SSP)

### Equipment Material

Certificates of compliance showing evidence of UL listing and conformance with applicable NEMA standards. Such certificates are not required if manufacturer's published data, submitted and approved, reflect UL listing or conformance with applicable NEMA standards.

### Switching Equipment

Evidence that ATS withstand current rating (WCR) has been coordinated with upstream protective devices as required by UL 1008.

### SD-10 Operation and Maintenance Data

### Switching Equipment Instructions

Six copies of operating and Six copies of maintenance manuals listing routine maintenance, possible breakdowns, repairs, and troubleshooting guide.

## 1.3 GENERAL REQUIREMENTS

### 1.3.1 Standard Product

Material and equipment shall be standard products of a manufacturer regularly engaged in manufacturing the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience use shall include applications in similar circumstances and of same design and rating as specified ATS. Equipment shall be capable of being serviced by a manufacturer-authorized and trained organization that is, in the Contracting Officer's opinion, reasonably convenient to the site.

### 1.3.2 Nameplate

Nameplate showing manufacturer's name and equipment ratings shall be made of corrosion-resistant material with not less than 1/8 inch tall characters. Nameplate shall be mounted to front of enclosure and shall comply with nameplate requirements of NEMA ICS 2.

### 1.3.3 Detail Drawings

The Contractor shall submit interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Device, nameplate, and item numbers shown in list of equipment and material shall appear on drawings wherever that item appears. Diagrams shall show interlocking provisions and cautionary notes, if any. Operating instructions shall be shown either on one-line diagram or separately. Unless otherwise approved, one-line and elementary or schematic diagrams shall appear on same drawing.

### 1.3.4 Switching Equipment

Upon request, manufacturer shall provide notarized letter certifying compliance with requirements of this specification, including withstand

current rating (WCR). The Contractor shall submit an operating manual outlining step-by-step procedures for system startup, operation, and shutdown. Manual shall include manufacturer's name, model number, service manual, parts list, and brief description of equipment and basic operating features. Manufacturer's spare parts data shall be included with supply source and current cost of recommended spare parts. Manual shall include simplified wiring and control diagrams for system as installed.

#### 1.4 SERVICE CONDITIONS

Seismic requirements shall be as specified in Section 26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT. ATS shall be suitable for prolonged performance under following service conditions:

### PART 2 PRODUCTS

#### 2.1 AUTOMATIC TRANSFER SWITCH (ATS)

- a. Design Standard: Russelectric, or equal.
- b. ATS shall be electrically operated and mechanically held in both operating positions. ATS shall be suitable for use in emergency systems described in NFPA 70. ATS shall be UL listed. ATS shall be manufactured and tested in accordance with applicable requirements of IEEE C37.90.1, IEEE C37.13, IEEE C62.41, IEEE 602, NEMA ICS 1, NEMA ICS 2, NEMA ICS 10 Part 2, UL 1008 and UL 1066. ATS shall conform to NFPA 110. To facilitate maintenance, manufacturer's instruction manual shall provide typical maximum contact voltage drop readings under specified conditions for use during periodic maintenance. Manufacturer shall provide instructions for determination of contact integrity. ATS shall be rated for continuous duty at specified continuous current rating. ATS shall be fully compatible and approved for use with BP/IS specified. BP/IS shall be considered part of ATS system. ATS shall have following characteristics:
  1. Voltage: 480 volts ac.
  2. Number of Phases: Three.
  3. Number of Wires: Three and/or Four.
  4. Frequency: 60 Hz.
  5. Poles: Three and/or four (Coordinate with Drawing E4.10)
  6. ATS WCR: Rated to withstand short-circuit current of 65,000 amperes, RMS symmetrical.
  7. Nonwelding Contacts: Rated for nonwelding of contacts when used with upstream feeder overcurrent devices shown and with available fault current specified.
  8. Main and Neutral Contacts: Contacts shall have silver alloy composition. Neutral contact continuous current rating shall be not less than twice the rating of main or phase contacts.

#### 2.1.1.1 Override Time Delay

Time delay to override monitored source deviation shall be adjustable from 0.5 to 6 seconds and **factory set at 4 second(s)**. ATS shall monitor phase conductors to detect and respond to sustained voltage drop of 15 percent of nominal between any two normal source conductors and initiate transfer action to emergency source and start engine driven generator after set time period. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Dropout voltage shall be adjustable from 75 to 98 percent of pickup value and factory set at 85 percent of nominal.

#### 2.1.1.2 Transfer Time Delay

Time delay before transfer to emergency power source shall be adjustable from 0 to 5 minutes and factory set at 0 minutes. ATS shall monitor frequency and voltage of emergency power source and transfer when frequency and voltage are stabilized. Pickup voltage shall be adjustable from 85 to 100 percent of nominal and factory set at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal and factory set at 90 percent.

#### 2.1.1.3 Return Time Delay

Time delay before return transfer to normal power source shall be adjustable from 0 to 30 minutes and factory set at 30 minutes. Time delay shall be automatically defeated upon loss or sustained undervoltage of emergency power source, provided that normal supply has been restored.

#### 2.1.1.4 Engine Shutdown Time Delay

Time delay shall be adjustable from 0 to 30 minutes and shall be factory set at 15 minutes.

#### 2.1.1.5 Auxiliary Contacts

Two normally open and two normally closed auxiliary contacts rated at 20 amperes at 480 volts shall operate when ATS is connected to normal power source, and two normally open and two normally closed contacts shall operate when ATS is connected to emergency source.

#### 2.1.1.6 Supplemental Features

ATS shall be furnished with the following:

- a. Engine start contact.
- b. Emergency source monitor.
- c. Test switch to simulate normal power outage.
- d. Voltage sensing. Pickup voltage adjustable from 85 to 100 percent of nominal; dropout adjustable from 75 to 98 percent of pickup.
- e. Time delay bypass switch to override return time delay to normal.
- f. Manual return-to-normal switch.
- g. Means shall be provided in the ATS to insure that motor/transformer

load inrush currents do not exceed normal starting currents. This shall be accomplished with either in-phase monitoring, time-delay transition, or load voltage decay sensing methods. If manufacturer supplies an in-phase monitoring system, the manufacturer shall indicate under what conditions a transfer cannot be accomplished. If the manufacturer supplies a time-delay transition system, the manufacturer shall supply recommendations for establishing time delay. If load voltage decay sensing is supplied, the load voltage setting shall be user programmable.

#### 2.1.7 Operator

Manual operator conforming to UL 1008 shall be provided, and shall incorporate features to prevent operation by unauthorized personnel. ATS shall be designed for safe manual operation under full load conditions. If manual operation is accomplished by opening the door, then a dead-front shall be supplied for operator safety.

#### 2.1.8 Override Switch

Override switch shall bypass automatic transfer controls so ATS will transfer and remain connected to emergency power source, regardless of condition of normal source. If emergency source fails and preferred source is available, ATS shall automatically retransfer to preferred source.

#### 2.1.9 Green Indicating Light

A green indicating light shall supervise/provide preferred power source switch position indication and shall have a nameplate engraved NORMAL .

#### 2.1.10 Red Indicating Light

A red indicating light shall supervise/provide emergency power source switch position indication and shall have a nameplate engraved EMERGENCY.

### 2.2 BY-PASS/ISOLATION SWITCH (BP/IS)

#### 2.2.1 Design (Basis of Design type RTB, with Model 2000 Control)

Bypass/isolation switch (BP/IS) shall permit load by-pass to either normal or emergency power source and complete isolation of associated ATS, independent of ATS operating position. BP/IS and associated ATS shall be products of same manufacturer and shall be completely interconnected and tested at factory and at project site as specified. BP/IS shall be manufactured, listed, and tested in accordance with paragraph AUTOMATIC TRANSFER SWITCH (ATS) and shall have electrical ratings that exceed or equal comparable ratings specified for ATS. Operating handles shall be externally operated and arranged so that one person can perform the bypass and isolation functions through the operation of a maximum of two handles within 5 seconds. The ATS shall have provisions for locking in the isolation position. Handle for manual operation shall be permanently attached to operating mechanism. BP/IS operation shall be accomplished without disconnecting switch load terminal conductors. Isolation handle positions shall be marked with engraved plates or other approved means to indicate position or operating condition of associated ATS, as follows:

- a. Indication shall be provided to show that ATS section is providing power to the load.



- b. Indication shall be provided of ATS isolation. The ATS controls shall remain functional with the ATS isolated or in bypass mode to permit monitoring of the normal power source and automatic starting of the generator in the event of a loss of the normal power source. In the isolated mode, the bypass section shall be capable of functioning as a manual transfer switch to transfer the load to either power source. The ATS shall be capable of undergoing functional operation testing without service interruption. The ATS may also be completely removed from the enclosure, if required for maintenance or repair, while the bypass section continues to power the load.

#### 2.2.2 Switch Construction

Bypass/isolation switch shall be constructed for convenient removal of parts from front of switch enclosure without removal of other parts or disconnection of external power conductors. Contacts shall be as specified for associated ATS, including provisions for inspection of contacts without disassembly of BP/IS or removal of entire contact enclosure. To facilitate maintenance, manufacturer shall provide instructions for determination of contact integrity. BP/IS and associated ATS shall be interconnected with suitably sized copper bus bars silver-plated at each connection point, and braced to withstand magnetic and thermal forces created at WCR specified for associated ATS.

#### 2.3 ENCLOSURE

ATS and accessories shall be installed in free-standing, floor-mounted, NEMA ICS 6, Type 1, smooth sheet metal enclosure constructed in accordance with applicable requirements of UL 1066 and/or UL 1008. Intake vent shall be screened and filtered. Exhaust vent shall be screened. Door shall have suitable hinges, locking handle latch, and gasketed jamb. Metal gauge shall be not less than No. 14. Enclosure shall be equipped with at least two approved grounding lugs for grounding enclosure to facility ground system using No. 4/0 AWG copper conductors. Factory wiring within enclosure and field wiring terminating within enclosure shall comply with NFPA 70. If wiring is not color coded, wire shall be permanently tagged or marked near terminal at each end with wire number shown on approved detail drawing. Terminal block shall conform to NEMA ICS 4. Terminals shall be arranged for entrance of external conductors from top and bottom of enclosure as shown. Provide compression type lugs T&B 54,000 Series for termination of feeder cables.

##### 2.3.1 Construction

Enclosure shall be constructed for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components. Enclosure of ATS with BP/IS shall be constructed to protect personnel from energized BP/IS components during ATS maintenance.

##### 2.3.2 Cleaning and Painting

Both the inside and outside surfaces of an enclosure, including means for fastening, shall be protected against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection is impractical. Finish shall be manufacturer's standard material,

process, and color and shall be free from runs, sags, peeling, or other defects. An enclosure marked Type 1, 3R, 4 or 12 shall be acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

## 2.4 TESTING

### 2.4.1 Factory Testing

A prototype of specified ATS shall be factory tested in accordance with UL 1008. In addition, factory tests shall be performed on each ATS as follows:

- a. Insulation resistance test to ensure integrity and continuity of entire system.
- b. Main switch contact resistance test.
- c. Visual inspection to verify that each ATS is as specified.
- d. Mechanical test to verify that ATS sections are free of mechanical hindrances.
- e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

### 2.4.2 Factory Test Reports

Manufacturer shall provide three certified copies of factory test reports.

## 2.5 FACTORY TESTING

The factory tests for ATS and By-Pass/Isolation switches shall be conducted in the following sequence:

- a. General
- b. Normal
- c. Overvoltage
- d. Undervoltage
- e. Overload
- f. Endurance
- g. Temperature Rise
- h. Dielectric Voltage-Withstand
- i. Contact Opening
- j. Dielectric Voltage-Withstand (Repeated)
- k. Withstand
- l. Instrumentation and Calibration of High Capacity
- m. Closing
- n. Dielectric Voltage-Withstand (Repeated)
- o. Strength of Insulating Base and Support

### 2.5.1 Viewing Ports

ATS and BP/IS switches shall be of draw-out construction. Viewing ports to inspect the contacts without requiring disassembly shall be provided.

### 2.5.2 Operating Handles

The operating handles shall be externally operated, and designed and constructed not to stop in an intermediate or neutral position during operation, but shall permit load by-pass and transfer switch isolation in no more than two manual operations which can be performed by one person in 5 seconds or less. The transfer speed will be independent of the operational speed of the switch handle or handles.

## PART 3 EXECUTION

### 3.1 INSTALLATION

ATS shall be installed as shown and in accordance with approved manufacturer's instructions.

### 3.2 INSTRUCTIONS

Manufacturer's approved operating instructions shall be permanently secured to cabinet where operator can see them. One-line and elementary or schematic diagram shall be permanently secured to inside of front enclosure door.

### 3.3 SITE TESTING

Following completion of ATS installation and after making proper adjustments and settings, site tests shall be performed in accordance with manufacturer's written instructions to demonstrate that each ATS functions satisfactorily and as specified. Contractor shall advise Contracting Officer not less than 5 working days prior to scheduled date for site testing, and shall provide certified field test reports within 2 calendar weeks following successful completion of site tests. Test reports shall describe adjustments and settings made and site tests performed. Minimum operational tests shall include the following:

- a. Insulation resistance shall be tested, both phase-to-phase and phase-to-ground.
- b. Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
- c. Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
- d. Low phase-to-ground voltage shall be simulated for each phase of normal source.
- e. Operation and settings shall be verified for specified ATS features, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
- f. Manual and automatic ATS and BP/IS functions shall be verified.
- g. Perform contact resistance tests.**

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### 3.4 DEMONSTRATION AND TRAINING

Follow Section 01 79 00 DEMONSTRATION AND TRAINING.

-- End of Section --

DRAFT

SECTION 26 51 00

INTERIOR LIGHTING

07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A580/A580M	(2018) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B164	(2003; R 2014) Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
IES HB-10	(2011; Errata 2015) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power

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### Circuits

IEEE 100

(2000; Archived) The Authoritative  
Dictionary of IEEE Standards Terms

### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101

(2021) Life Safety Code

NFPA 70

(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA  
20-1; TIA 20-2; TIA 20-3; TIA 20-4)  
National Electrical Code

### U.S. ARMY CORPS OF ENGINEERS (USACE)

ETL 1110-3-432

(1991) Exit Signs: Engineering and Design

### U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star

(1992; R 2006) Energy Star Energy  
Efficiency Labeling System (FEMP)

### UNDERWRITERS LABORATORIES (UL)

UL 1598

(2021; Reprint Jun 2021) Luminaires

UL 844

(2012; Reprint Oct 2021) UL Standard for  
Safety Luminaires for Use in Hazardous  
(Classified) Locations

UL 924

(2016; Reprint May 2020) UL Standard for  
Safety Emergency Lighting and Power  
Equipment

## 1.2 INCLUDED WORK

- a. Interior luminaires and accessories.
- b. Exterior building mounted luminaires and accessories.
- c. LED modules and power supplies.

## 1.3 RELATED REQUIREMENTS

- a. Section 11 53 13 FUME HOODS, for fume hood fixtures.
- b. Section 13 21 00 CONTROLLED ENVIRONMENT ROOMS, for controlled environmental room fixtures.
- c. Section 26 09 23 INTEGRATED LOW VOLTAGE LIGHTING CONTROL SYSTEM.
- d. Section 26 09 23.13 LIGHTING CONTROL DEVICES.
- e. Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 1.4 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as

defined in IEEE 100.

- b. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

#### 1.5 EARLY SUBMITTAL PACKAGE

- a. Prior to submitting Shop Drawings and Product Data, submit manufacturer and model number proposed for each fixture specified.
- b. Actual date of early submittal package shall be determined by Contractor and shall allow sufficient time for potential disapprovals, re-submittal for pre-approval, ordering, Shop Drawing and Product Data preparation, submittal for Government review(s), fabrication, delivery, and installation, in compliance with overall Project Schedule.
- c. Shop Drawings and Product Data, if submitted without early submittal package, or not compliant with early submittal package comments, will be returned without review.
- d. Documentation verifying specification requirements will be met.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Product Data, shop drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES HB-10, as applicable, for the lighting system specified.

##### SD-01 Preconstruction Submittals

###### Early Submittal Package; G, AE

Submit manufacturer and model number proposed for each fixture as specified under EARLY SUBMITTAL PACKAGE article in this Section.

##### SD-02 Shop Drawings

Shop drawings are required for the following components:

LED lighting fixtures; G, AE

LED Power Supplies; G, AE

Exit signs; G, AR

Emergency lighting equipment; G, AR

Show:

Details of construction and finishes. Catalog cuts without

required details will not be approved.

Fixture and accessory drawings (indicate scale).

For continuous pattern fixtures, indicate layout, individual section lengths, and lamp quantities. Show details of connections, corners and extensions, end plates, and mounting. Include pendant or bracket locations and show remote transformers and ballast.

List of fixture types and quantities.

#### SD-03 Product Data

Submit LED Module catalog cut indicating wattage, lumen output, color temperature, CRI, life, and beam angle.

Submit photometric data by an independent testing laboratory when requested. Show optical performance developed using methods of IES of North America as follows:

Submit candlepower data presented graphically and numerically, in 10 degree increments. Develop data for up and down quadrants normal, parallel, and at 45 degrees to lamp if light output is asymmetric.

LED lighting fixtures; G, AE

LED Power Supplies; G, AE

Exit signs; G, AR

Emergency lighting equipment; G, AR

#### SD-04 Samples

Finishes; G, AE

Only when specifically requested, submit 4 by 6 inch samples of each type of finish specified on metal to be used.

Lighting Fixtures; G, AE

Only when specifically requested; following shop drawings, product data, and finishes; deliver one sample fixture of each type requested to AE's office.

Samples shall be complete with lamps, ballasts, cords and other accessories, ready for operation.

After review and approval, transfer sample fixtures from AE's office to job site for comparison with fixtures delivered for installation. Approved unblemished samples may be used in the work.

#### SD-06 Test Reports

Operating Test



Conduct as part of field quality control operating tests as specified in Part 3 of this Section.

#### SD-10 Operation and Maintenance Data

Lighting Fixtures; G, AR

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

### 1.7 QUALITY ASSURANCE

#### 1.7.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.7.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.7.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.7.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

##### 1.7.2.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications

for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

## 1.8 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

Furnish the manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- a. Use fixtures conforming to UL Standards, bearing UL labels, and manufactured in accordance with NEC.
- b. Make fixture parts of materials resistant to corrosion and thermal and mechanical stresses encountered in normal application. Provide accessory equipment such as starters, sockets and lampholders, approved by UL and ETL, unless otherwise noted.
- c. Lighting fixtures shall be furnished completely assembled with wiring and mounting devices and ready for installation at the locations indicated. Lighting fixtures shall include wiring channel, end plates, end caps, side panels, top reflectors, bottom closures, LED modules and LED power supplies, suspension stems, wiring, and other necessary materials and devices.
- d. Electrical components shall be accessible and removable through fixture without having to remove fixture from mounting. Ballasts, transformers and wiring shall be completely enclosed and shall be easily accessible. Lamps shall be replaceable without the use of tools and without removal of other lamps and equipment. When two or more fixtures are joined together in continuous rows, the wiring channel shall form an open and continuous wireway.
- e. Use catalog numbers listed on fixture schedule as a guide only. Follow modifications and other requirements shown or specified.
- f. Coordinate fixtures with ceiling construction. Advise AE and Contracting Officer of discrepancies between fixture catalog references shown or specified and actual ceiling construction, prior to submission of shop drawings. Failure to do so will require correction at no additional cost.

### 2.2 FIXTURE CONSTRUCTION

#### 2.2.1 Housings

##### 2.2.1.1 LED Lighting Fixtures

Minimum 20 gauge sheet steel; integral end plates and trim flanges to suit ceiling construction. Provide wire way covers with captive retainers to allow access to electrical components without use of tools.

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### 2.2.1.2 Extruded Aluminum Housings

Where scheduled, shall be at least 1/8 inch thick.

### 2.2.1.3 Post-Paint

Punch and form housings prior to finishing (post-paint).

### 2.2.2 Trim

For square and rectangular fixtures, miter and continuously weld corners. Miter perimeter inverted T-bar angles at corners. Do not butt or overlap squared ends. Finish joints smooth.

### 2.2.3 Castings

Uniform quality, free from imperfections affecting strength and appearance. Exterior surfaces, if not receiving a finish coat, shall be smooth and match adjacent surfaces. Apply at least one coat of clear methacrylate lacquer unless a painted finish is specified.

### 2.2.4 Lens/Louver Frames

Extruded aluminum with mitered corners unless scheduled otherwise. Hinging or other normal motion shall not cause lens or louver to drop out.

### 2.2.5 Gaskets

Provide gaskets at face plates or frames of recessed fixtures which serve as ceiling trim and which allow interior access. Provide moisture seal gaskets at exterior locations and in other areas designated. Secure frames to fixture bodies with screws or other means, to result in tight installation, without light leaks. See schedules for other types of seals and gaskets.

### 2.2.6 Ventilation

Provide ventilation openings of adequate size and quantity to permit operation of lamps and ballast without affecting rated output or life expectancy. Include wire mesh screens.

## 2.3 SOLID-STATE LUMINAIRES - ADDITIONAL REQUIREMENTS

- a. Solid state modules and driver shall be provided and warrantied by luminaire manufacturer.
- b. Utilize zhaga compliant modules wherever applicable.
- c. Solid-state modules shall have:
  1. Uniform color temperature as shown on schedule. Color temperature measurement shall have a maximum 3 SDCM on the MacAdam Ellipse for frosted lensed luminaires, and 2 SDCM for other luminaire types.
  2. Minimum color rendering index (CRI) of 80.
  3. LED module light output and efficacy shall be measured in accordance with ANSI/IES LM-79 standards.

4. Driver and LED module shall have a minimum rated life of 50,000 hours. LED life and lumen maintenance shall be measured in accordance with ANSI/IES LM-80 standards.
5. Individual LEDs shall be connected such that a failure of one LED will not result in a light output loss of the entire luminaire.
- d. Driver shall be compatible with solid-state modules and control devices specified.
  1. Driver shall operate from 60 Hz input source of 120V with sustained variations of +/- 10 percent (voltage and frequency).
  2. Driver input current shall have Total Harmonic Distortion (THD) of less than 20 percent when operated at nominal line voltage.
  3. Driver shall have a Power Factor greater than 0.90.
  4. Driver shall avoid interference with infrared devices and eliminate visible flicker.
  5. Driver shall comply with IEEE C62.41 Category A for Transient protection.
  6. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
  7. Dimmable drivers shall be capable of continuous dimming over a range of 100% to 1% of rated lumen output. Dimming shall be controlled by a 0-10VDC signal, unless otherwise specified in Lighting Fixture Schedule.
  8. Control device must be compatible with type of driver, and coordinated prior to submission of shop drawings. List of compatible dimming controllers must include the range of perceived brightness. Flicker shall not be visible throughout the dimming range.
  9. If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires and provide remote mounting hardware and enclosures as required.
  10. Operating temperature range must be suitable field temperature conditions within exterior and gasketed fixtures.
- e. Fixture shall have proper heat sink to assure LED junction temperature ratings are not exceeded. Manufacturer shall provide ambient operating temperature range for which product is warrantied.

#### 2.4 REFLECTORS

- a. High-purity #12 aluminum reflector sheet, 0.047 inch (15 gauge) or heavier if specified, free from fabrication or assembly damages. No exposed rivets, springs or other hardware after installation.
- b. Shape reflectors in modified elliptical or parabolic contour to produce no apparent brightness. Lamp image or any part of lamp shall

not be visible in 45 degree zone.

- c. Reflector and Baffle Finish: First-quality "Alzak" anodized finish, of specular color as specified.

## 2.5 FIXTURE LENSES

For fixture: Extruded 100 percent virgin acrylic male conical prismatic, minimum thickness 0.150 inch, size as required.

## 2.6 FINISHES

- a. As selected from manufacturer's standards unless scheduled otherwise.
- b. Painted surfaces, except as scheduled otherwise: Manufacturer's standard metal pretreatment and baked or air dried, light stabilized enamel finish; acrylic, alkyd, epoxy, polyester or polyurethane. White finishes shall have minimum 85 percent reflectance.
- c. Unpainted Aluminum Surfaces: Clear anodic coating, satin finish, except as scheduled otherwise.

## 2.7 RECESSED AND FLUSH-MOUNTED FIXTURES

Provide type that can be serviced from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

### 2.7.1 Baffles and Gaskets

As required to prevent light leakage.

### 2.7.2 Flanged Fixtures

Are required in all ceiling systems except exposed grid lay-in panel type.

## 2.8 SUSPENDED FIXTURES

### 2.8.1 Unfinished Spaces

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging. Single-unit suspended fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

### 2.8.2 Finished Spaces

Unless otherwise noted, provide manufactured cable or stem and outlet box canopy; contemporary design with swivel self-aligned features; size canopy to cover outlet box; finished to match fixture. Coordinate pendant location with ceiling tiles/ceiling grid, and submit coordinated mounting accessories as part of shop drawing submission. For high intensity discharge lamps, use stems suspended from swivel shock-absorbing fittings.

## 2.9 FIXTURES FOR HAZARDOUS LOCATIONS

In addition to requirements stated herein, provide fluorescent HID incandescent fixtures for hazardous locations which conform to UL 844 or which have Factory Mutual certification for the class and division indicated.

## 2.10 EXIT SIGNS

- a. Exit signs shall use no more than 5 watts.
- b. Exit signs illumination performance shall comply with ETL 1110-3-432.

### 2.10.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

## 2.11 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated. Provide accessories required for remote-mounted lamps where indicated. Remote-mounted lamps shall be as indicated.

### 2.11.1 Emergency Lighting Unit

Description: Self-diagnostic, self-contained units to automatically furnish full rated illumination instantaneously upon failure of normal power source.

#### 2.11.1.1 Battery

- a. Description: Maintenance-free lead-calcium 6 volt, with minimum output capacity of 15 watts for 90 minutes.
- b. Continuous operation of a minimum of two sealed beam lamps for 90 minutes before capacity of battery is exceeded.

#### 2.11.1.2 Case

- a. Wall mounted, ventilated UV stabilized, impact resistant polycarbonate with visual indicators in plain view; facilities for mounting 2 lamps on unit.
- b. Finish: White.
- c. Connections: Suitable for 120 or 277 volt input and 6 volt output.

#### 2.11.1.3 Components

- a. Transfer Circuit: Automatically energize lamps upon failure of normal source; de-energize lamps and activate high-rate charge upon restoration of normal source.

- b. Battery Charger: Automatic two-rate or acceptable solid-state pulse type capable of replacing maximum charge taken out in 1-1/2 hour emergency discharge period within 12 hours; manual two-rate charger will not be accepted. Provide visual signal to indicate state of charge.
- c. Integrally mounted, adjustable emergency lights.
- d. Integrally mounted status lights.
- e. Self-Diagnostics and self-testing.

#### 2.11.1.4 Accessories

Remote Lights: 6 watt, sealed beam lamp in adjustable wall mounted fixture, UL listed for wet locations. Provide black finish.

### 2.12 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

#### 2.12.1 Wires

ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter 12 gage.

#### 2.12.2 Wires, for Humid Spaces

- a. ASTM A580/A580M, composition 302 or 304, annealed stainless steel 0.1055 inches in diameter 12 gage.
- b. ASTM B164, UNS N04400, annealed nickel-copper alloy 0.1055 inches in diameter 12 gage).

#### 2.12.3 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

#### 2.12.4 Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

### 2.13 EQUIPMENT IDENTIFICATION

#### 2.13.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 2.13.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation voltage and power.

## 2.14 LIGHT FIXTURE SCHEDULE

Design Standard Manufacturers are shown on Lighting Fixture Schedule Drawing. Refer to schedule on drawings for fixture descriptions and manufacturer.

## PART 3 EXECUTION

### 3.1 COORDINATION

- a. Fixture layouts are diagrammatic and approximate. Review and approve fixture locations shown on acoustical ceiling shop drawings prior to installation.
- b. Coordinate required plenum clearances with ductwork and piping. In exposed ceiling areas, coordinate fixture locations, mounting heights, and supports with other trades.
- c. Coordinate fixture mounting type with ceilings prior to submission of shop drawings. Advise AE of any discrepancy. Failure to do so will result in correction at no additional cost to Government.

### 3.2 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Assemble, wire and install lighting fixtures, with lamps, in such manner to ensure correct operation.

#### 3.2.1 Lighting Fixtures

- a. Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures unless otherwise noted. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.
- b. Ground entire fixture to building grounding system.

#### 3.2.2 Recessed

- a. Note that specifications for recessed fixtures generally do not include mounting accessories, and that each fixture type may be used in several different ceiling types. Verify mounting details for each space; provide correct fixture flange mounting accessories for each condition. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires per fixture and located near each corner of each fixture. Attach lay-in fluorescent troffers to ceiling suspension system, for alignment only.
- b. Downlights or fixtures smaller in size than the ceiling grid shall be aligned with rails spanning between runners of suspension system and independently supported from the building structure by a minimum of four wires per fixture spaced approximately equidistant around the fixture. Provide wires for lighting fixture support in this section.



Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

- c. Support troffers in gypsum board ceilings from plaster frames, with adjustable lugs on side of fixture or yoke mounting as recommended by fixture manufacturer.

### 3.2.3 Surface Mounted Fixture Fixtures

- a. Attach surface-mounted lighting fixtures to ceiling system with positive clamping devices that completely surround supporting members. Attach safety wires between clamping device and adjacent ceiling hanger or to structure above. In no case shall fixture load exceed design carrying capacity of supporting member.
- b. Do not remove ceiling material above surface mounted fixtures.

### 3.2.4 Suspended Fixtures

- a. Support pendant-hung lighting fixtures directly from structure above, using wires or rods, without relying on ceiling suspension system for support.
- b. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces.
- c. Pendants shall be contemporary type. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be as recommended by the manufacturer.

### 3.3 CONTINUOUS FIXTURE PATTERNS

- a. Fasten sections together for continuously aligned appearance, with no dimpling or light leakage. Provide end extensions where required.
- b. Where fixtures run continuously around inside or outside corners, provide prefabricated corner pieces. Run fixture lenses, baffles or louvers continuously with fixture. Miter and/or fan at corners as directed.
- c. Where continuous runs do not end at a wall or fascia, provide a finished end plate, with no visible holes and concealed fasteners.
- d. Coordinate pendant location to permit alignment between rows or patterns.

### 3.4 EXIT SIGNS AND EMERGENCY LIGHTING UNITS

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area unless otherwise noted.

### 3.5 EQUIPMENT TESTING

Equipment testing shall comply with current IES Lighting Measurement requirements:

LM-15-03, Guide for reporting engineering data for indoor luminaires.

LM-28-14, Projecting long term luminous flux maintenance of LED lamps and luminaires.

LM-63-02, Standard file format for electronic transfer of photometric data.

LM-72-97, Directional positioning of photometric data.

LM-79-08, Electrical and photometric measurements of Solid-state lighting products.

LM-80-08, Measuring lumen maintenance of LED light sources.

LM-82-12, LED light engines and LED lamps for electrical and photometric properties as a function of temperature.

LM-84-14, Measuring luminous flux and color maintenance of LED lamps, light engines and luminaires.

LM-85-14, Electrical and photometric measurements of high-powered LED products.

### 3.6 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.7 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E (2005) Cabinets, Racks, Panels, and Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66 (2019) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NEMA WC 63.1 (2005) Twisted Pair Premise Voice and Data Communications Cables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.0 (2020e) Generic Telecommunications Cabling for Customer Premises

TIA-568.1 (2020e) Commercial Building Telecommunications Infrastructure Standard

TIA-568.2 (2018d) Balanced Twisted-Pair Telecommunications Cabling and Components Standards

TIA-569 (2019e) Telecommunications Pathways and Spaces

TIA-606 (2021d) Administration Standard for Telecommunications Infrastructure

# Repair Steam Sterilization Plant (SSP)

## U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

### FCC Part 68

Connection of Terminal Equipment to the  
Telephone Network (47 CFR 68)

## UNDERWRITERS LABORATORIES (UL)

UL 1863	(2004; Reprint Oct 2019) UL Standard for Safety Communication Circuit Accessories
UL 444	(2017; Reprint Jun 2021) UL Standard for Safety Communications Cables
UL 514C	(2014; Reprint Feb 2020) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(2017; Reprint Mar 2018) UL Standard for Safety Marking and Labeling Systems

## 1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

## 1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568.0, TIA-568.1, TIA-568.2, TIA-569, TIA-606 and IEEE 100 and herein.

## 1.4 SYSTEM DESCRIPTION

The building communications cabling and pathway system shall include permanently installed horizontal cabling, horizontal pathways, work area pathways, communications outlet assemblies, cable trays, raceways, mounting boxes, pull boxes and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone, data (including LAN) system signals between equipment items in a building. Wiring system shall be based on TIA-568.0 star topology. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Telecommunications drawings; G, AE

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

### SD-03 Product Data

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Telecommunications cabling; G, AR

Modular Copper Cable Patch Panels; G, AR

Patch cords; G, AR

Telecommunications outlet/connector assemblies; G, AR

Connector blocks; G, AR

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

### SD-06 Test Reports

Telecommunications cabling testing

### SD-07 Certificates

Telecommunications Contractor Qualifications

Key Personnel Qualifications

Manufacturer Qualifications

Test plan

### SD-09 Manufacturer's Field Reports

Factory reel tests

### SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G, AR

Record Documentation; G, AR

## 1.6 QUALITY ASSURANCE

### 1.6.1 Shop Drawings

In exception to Section 01 33 00, SUBMITTAL PROCEDURES, submit shop drawings a minimum of 14 by 20 inches in size using a minimum scale of 1/8 inch per foot. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the

nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

#### 1.6.1.1 Telecommunications Drawings

Provide drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the Teledatal rooms to the work area outlets. The following drawings shall be provided as a minimum:

- a. T1 - Layout of complete building area associated with this project..
- b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.
- c. T4 - Typical Detail Drawings - Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

#### 1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with TIA-606. Drawings shall show layout of applicable equipment patch panels and equipment spaces on cabinet/racks. Drawings shall include a complete list of new equipment and material.

#### 1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

##### 1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

##### 1.6.2.2 Key Personnel

- a. Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation

depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

- b. Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products and a minimum of 3 years experience in the installation of the copper and fiber optic cable and components provided for this project.
- c. Only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

#### 1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years' experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568.0, TIA-568.1 and TIA-568.2.

#### 1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories 60 days prior to the proposed test date. Include procedures for testing.

#### 1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

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### 1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

### 1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 6 months prior to date of delivery to site shall not be used, unless specified otherwise.

## 1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

## 1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

## 1.9 WARRANTY

The equipment items shall be supported by service organizations which can provide warranty service within 5 working days in order to render satisfactory service during the warranty period of the contract. The installation shall be warranted against defects in materials and installation for a period of one year from final acceptance. The performance of the cable systems shall be warranted for a period of at least 10 years.

## 1.10 MAINTENANCE

### 1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system. Submit operations and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION.

### 1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cable plant management, patch panel layouts and cover plate assignments as a minimum. T5 drawings shall be provided in hard copy format and on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, shall be provided. Provide the following T5 drawing documentation as a minimum:



- a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit in accordance with TIA-606. Include manufacture date of cable with submittal.
- b. Termination Hardware - A record of installed patch panels, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA-606. Documentation shall include the required data fields as a minimum in accordance with TIA-606.

## PART 2 PRODUCTS

### 2.1 COMPONENTS

UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

### 2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

### 2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568.0, TIA-568.1, TIA-568.2 and NFPA 70. Provide a labeling system for cabling as required by TIA-606 and UL 969. Ship cable bearing manufacture date for all cable used on this project. Cabling manufactured more than 6 months prior to date of installation shall not be used.

#### 2.3.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568.2.

##### 2.3.1.1 Horizontal Copper Unshielded Twisted Pair (UTP)

Provide horizontal copper cable in accordance with TIA-568.2, UL 444, NEMA WC 63.1, ANSI/NEMA WC 66 Category 6 UTP, 100 ohm, with a blue thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet. The word "FEET" or the abbreviation "FT" shall appear

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after each length marking. Provide communications plenum (CMP) rated cabling in accordance with NFPA 70.

### 2.4 COMMUNICATIONS ROOMS

Provide connecting hardware and termination equipment in the Teledatal rooms to facilitate installation as shown on design drawings for terminating cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA-606.

#### 2.4.1 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords on 19 inch equipment racks, cabinets and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack, cabinet panels, and backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws, and nuts and lockwashers.

#### 2.4.2 Patch Cords

Provide cords for the number of horizontal and backbone cables terminated on the panel plus 10 percent spare. Provide patch cords, as complete assemblies, with matching connectors as specified. Patch cords shall meet minimum performance requirements specified in TIA-568.0, TIA-568.1 and TIA-568.2 for cables, cable length and hardware specified. Coordinate patch cord cable colors and lengths with Contracting Officer.

##### 2.4.2.1 Modular Copper Cable Patch Panels

Provide in accordance with TIA-568.0 and TIA-568.1. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements for telephone backbone cables and Category 6 for horizontal cables. Panel shall be constructed of 0.09 inch minimum aluminum and shall be compatible with an ECIA EIA/ECA 310-E 19 inch equipment cabinets and racks. Panel shall provide non-keyed, 8-pin modular ports, wired to T568B. Patch panels shall terminate the building cabling on insulation displacement connectors (IDC). The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

### 2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

#### 2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568.0, TIA-568.1, and TIA-568.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using IDC, color-coded for T568B wiring. Each outlet/connector shall be wired T568B. UTP outlet/connectors shall comply with TIA-568.2 for 200 mating cycles.

#### 2.5.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568.0, TIA-568.1, TIA-568.2; flush or oversized to match receptacle/switch cover

plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS unless otherwise noted. Provide labeling in accordance with the paragraph LABELING in this section.

## 2.6 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00, FIRESTOPPING.

## 2.7 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

## 2.8 TESTS, INSPECTIONS, AND VERIFICATIONS

### 2.8.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with TIA-568.2.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with TIA-568.0, TIA-568.1, TIA-568.2, TIA-569, NFPA 70, and UL standards as applicable. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 27 05 28.36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.

### 3.1.1 Cabling

Install telecommunications cabling system as detailed in TIA-568.0, TIA-568.1, and TIA-568.2. Screw terminals shall not be used except where specifically indicated on plans. Use an approved IDC tool kit for copper cable terminations. Do not untwist UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 ft. in the telecommunications room, and 12 inches in the work area outlet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

#### 3.1.1.1 Open Cable

Use only where specifically indicated for use in cable trays, above hung ceilings or below raised floors. Install in accordance with TIA-568.0, TIA-568.1, TIA-568.2. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

- a. Plenum cable shall be used throughout. Plenum cables shall comply with flammability plenum requirements of NFPA 70.

#### 3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings between the Teledatal rooms and the telecommunications outlet assemblies at workstations.

#### 3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70. Provide building pathway as specified in Section 26 20 00, INTERIOR DISTRIBUTION SYSTEMS.

#### 3.1.3 Service Entrance Conduit, Underground

Provide service entrance underground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

#### 3.1.4 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS. Only CMP type cables shall be installed.

#### 3.1.5 Work Area Outlets

##### 3.1.5.1 Terminations

Terminate UTP cable in accordance with TIA-568.0, TIA-568.1, TIA-568.2 and wiring configuration as specified.

##### 3.1.5.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

##### 3.1.5.3 Cables

Unshielded twisted pair cables shall have a minimum of 6 inches of slack cable loosely coiled in outlet box. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

##### 3.1.5.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

### 3.1.6 Telecommunications Space Termination

Install termination hardware required for cable system. An IDC tool shall be used for terminating copper cable to insulation displacement connectors.

#### 3.1.6.1 Connector Blocks

Connector blocks shall be mounted in orderly rows and columns as shown. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

#### 3.1.6.2 Patch Panels

Patch panels shall be mounted with sufficient ports to accommodate the installed cable plant plus 10 percent spares.

- a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel as recommended by the manufacturer to prevent movement of the cable.

### 3.1.7 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00, FIRESTOPPING.

### 3.1.8 Grounding and Bonding

Provide in accordance with NFPA 70 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

## 3.2 LABELING

### 3.2.1 Labels

Provide labeling in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process or laser printer.

### 3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA-606.

### 3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA-606.

## 3.3 TESTING

### 3.3.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568.0, TIA-568.1, TIA-568.2. Provide manufacturer certification for factory reel tests.

#### 3.3.1.1 Inspection

Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568.0, TIA-568.1, and TIA-568.2. Visually confirm appropriate UTP cable Categories marking of outlets, cover plates, outlet/connectors, and patch panels.

#### 3.3.1.2 Performance Tests

Perform testing for each outlet as follows:

- a. Perform Category 6 permanent link tests in accordance with TIA-568.0, TIA-568.1 and TIA-568.2 using test instruments with level 3 or level 4 accuracy programmed by the manufacturer for Category 6.

-- End of Section --

SECTION 28 20 01.00 10

ELECTRONIC SECURITY SYSTEM (FOUO)

11/07

PART 1 GENERAL

1.1 REFERENCE SPECIFICATION

See Section 28 20 01.00 10 under separate cover.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 28 31 76

INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM (FA/MNS)  
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2 (2020) American National Standard Method for Measuring the Intelligibility of Speech Over Communication Systems (ASA 85)

FM GLOBAL (FM)

FM P7825 FM Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16 (2020) Sound System Equipment - Part 16: Objective Rating Of Speech Intelligibility By Speech Transmission Index

IEC 60849 (1998) Sound Systems For Emergency Purposes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 170 (2021) Standard for Fire Safety and Emergency Symbols

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 72 (2022) National Fire Alarm and Signaling Code

NFPA 90A (2021) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1480 (2016; Reprint Sep 2017) UL Standard for Safety Speakers for Fire Alarm and Signaling Systems, Including Accessories



## Repair Steam Sterilization Plant (SSP)

UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 2017	(2008; Reprint Dec 2018) UL Standard for Safety General-Purpose Signaling Devices and Systems
UL 268	(2016; Reprint Nov 2021) UL Standard for Safety Smoke Detectors for Fire Alarm Systems
UL 268A	(2008; Reprint Oct 2014) Smoke Detectors for Duct Application
UL 464	(2016; Reprint Sep 2017) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 864	(2014; Reprint May 2020) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems
UL Electrical Construction	(2012) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

### 1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

- a. Section 21 10 01 COMBINED STANDPIPE AND WET PIPE FIRE SPRINKLER SYSTEM, FIRE PROTECTION.
- b. Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION AND EXHAUST SYSTEMS
- c. Section 08 71 00 DOOR HARDWARE for door release, door unlocking and additional work related to finish hardware.
- d. Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

### 1.3 SUBMITTALS

Government review and approval from the Army Corps of Engineers, Baltimore District, Fire Protection Engineer is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will also review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ISO A1.

Wiring Diagrams; G, AE FPE

Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to FA/MNS control units, initiating circuits, switches, relays and terminals.

Provide complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

System Layout; G, AE FPE

Provide plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170, Fire Safety Symbols.

System Operation; G, AE FPE

Provide a complete list of device addresses and corresponding messages.

Initiating Devices; G, AE FPE

Provide data on each circuit to indicate that there remains at least 25 percent spare capacity for initiating devices after additions. Annotate data for each circuit on the drawings.

Notification Appliances; G, AE FPE

Provide data on each circuit to indicate that there remains at least 50 percent spare capacity for audible and visual notification appliances after additions. Annotate data for each circuit on the drawings.

Amplifiers; G, AE FPE

Provide data to indicate that the amplifiers have sufficient capacity after additions to simultaneously drive all notification speakers to produce the following output levels plus 50 percent spare capacity. Annotate data for each circuit on the drawings.

- 1) 100 dBA throughout mechanical, electrical and elevator rooms.
- 2) 95 dBA in the vicinity of fume hoods, biosafety cabinets, cage washers and ventilated holding racks.
- 3) 70 dBA throughout all other rooms.

SD-03 Product Data

Include UL or FM listing cards for equipment provided.

Manual stations; G, AE FPE

Batteries; G, AE FPE

Smoke sensors; G, AE FPE

Wiring and cable; G, AE FPE

Notification appliances; G, AE FPE

Addressable initiating device circuit interface; G, AE FPE

Amplifiers; G, AE FPE

SD-05 Design Data

System Operation; G, AE FPE

Provide a complete description of the system operation detailing every operation performed upon receipt of an alarm signal from every initiating device provided under this contract.

Battery power calculations; G, AE FPE

Provide battery calculations as required in paragraph Battery Power Calculations.

SD-06 Test Reports

Field Quality Control test reports

Testing Procedures

Smoke sensor testing procedures

SD-07 Certificates

Installer Qualifications

SD-09 Manufacturer's Field Reports

Fire Alarm/Mass Notification System

Include initiating and notification appliances, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information. The Contractor shall include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions; G, AR

Six copies of the Operation and Maintenance Instructions, indexed and in booklet form shall be submitted. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.

Original and backup copies of all software delivered for this project shall be provided, on each type of CD/DVD media utilized.

Instruction of Government Employees; G, AR

Submit the installers training history for the employees involved with this contract.

#### SD-11 Closeout Submittals

##### As-Built Drawings

Prepare and submit to the Contracting Officer. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

## 1.4 DESCRIPTION OF WORK

### 1.4.1 Scope

Under the original project, Mechanical 1SA202 was largely considered to be unoccupied. The whole space is being considered occupied under this contract. The work of this section includes design, modification, and expansion of the existing Johnson Controls (formerly SimplexGrinnell) FA/MNS to comply with all referenced codes and standards. Provide additional fire alarm pull stations, circuit interface modules, and alarm notification appliances. Provide additional amplifiers if required to support added speakers. Relocate existing manual fire alarm stations and notification appliances that are no longer required in their original locations to where they are needed to achieve code compliance. Provide system complete and ready for operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 72, IEC 60849, IEC 60268-16, except as modified herein. Final quantities, layout of initiating devices, notification appliances, and circuit interfaces are the responsibility of the Contractor.

### 1.4.2 Definitions

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

- a. Analog/Addressable System: A system where multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.

- b. Interface Device: An addressable device that interconnects hard wired systems or devices to an analog/addressable system.
- c. Remote Fire Alarm and Mass Notification Control Unit (FACU): A control panel, electronically remote from the fire alarm and mass notification control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.
- d. Fire Alarm and Mass Notification Control Panel (FACP): A master control panel having the features of a fire alarm and mass notification control unit and fire alarm and mass notification control units are interconnected. The panel has processing logic, memory, input and output terminals, video display unit (VDU), keyboard and printer.
- e. NAC Zone: A portion of the building in which all notification appliances operate simultaneously regardless of physical wiring. NAC zones are shown on drawings.

#### 1.5 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing building FA/MNS and shall not impair reliability or operational functions of existing FA/MNS.

##### 1.5.1 Qualifications

###### 1.5.1.1 Design Services

Installations requiring completion of installation drawings and specification or modifications of fire detection, fire alarm, mass notification system, fire suppression systems or mass notification systems shall require the services and review of a qualified engineer. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

- a. A registered professional engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of four years ' work experience in fire protection engineering.
- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. Registered Professional Engineer with verification of experience and at least four years of current experience in the design of the fire protection and detection systems.
- d. A NICET Level 4 Fire Alarm Technician.

###### 1.5.1.2 Supervisor

The installing Contractor shall provide the following: A NICET Level 4 Fire Alarm Technician shall supervise the installation of the fire alarm

system/mass notification system. The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.5.1.3 Technician

The installing Contractor shall provide the following: FA/MNS Technicians with a minimum of four years of experience shall be utilized to assist in the installation and terminate fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.5.1.4 Installer

The installing Contractor shall provide the following: Fire Alarm installer with a minimum of two years of experience shall be utilized to assist in the installation of fire alarm/mass notification devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system/mass notification system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.5.1.5 Test Personnel

The installing Contractor shall provide the following: Fire Alarm Technicians with a minimum of eight years of experience shall be utilized to test and certify the installation of the fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.5.1.6 Manufacturer's Representative

The fire alarm and mass notification equipment manufacturer's representative shall be present for the connection of wiring to the control panel. The Manufacturer's Representative shall be an employee of the manufacturer with necessary technical training on the system being installed.

#### 1.5.2 Manufacturer Qualifications

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

#### 1.5.3 Regulatory Requirements

Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM P7825.

##### 1.5.3.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in

UL Fire Prot Dir or approved by FM and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM P7825. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

#### 1.5.3.2 Fire Alarm/Mass Notification System

The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory for the intended use. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

#### 1.5.3.3 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with UL Fire Prot Dir, UL Electrical Construction, or FM P7825.

#### 1.5.4 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and the equipment shall have been commercially available for at least two years prior to bid opening.

#### 1.5.5 Modification of References

- a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Contracting Offices Designated Representative (COR).
- b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

#### 1.7 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

##### 1.7.1 System and System Equipment

The FA/MNS Operation and Maintenance Instructions shall include:

- a. "Manufacturer Data Package 5" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and

complete description of equipment and their basic operating features.

- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project shall be provided, on each type of CD/DVD media utilized.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

#### 1.7.2 Technical Data and Computer Software

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

#### 1.8 SPARE PARTS AND TOOLS

##### 1.8.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

##### 1.8.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

##### 1.8.3 Spare Parts

Furnish the following spare parts and accessories:

- a. Four fuses for each fused circuit.
- b. Three break rods for manual stations.



## Repair Steam Sterilization Plant (SSP)

### 1.8.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

### 1.9 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data that relates to computer software) that is specifically identified in this project, and may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- a. Identification of programmable portions of system equipment and capabilities.
- b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- d. Operation and maintenance manuals.

### 1.10 KEYS

Keys and locks for equipment shall be identical. Provide not less than six keys of each type required. All keys and locks shall be mastered to a single key as required by the local AHJ.

## PART 2 PRODUCTS

### 2.1 GENERAL PRODUCT REQUIREMENT

All fire alarm and mass notification equipment shall be listed for use under the applicable reference standards. Interfacing of Listed UL 864 or similar approved industry listing with Mass Notification Panels listed to UL Standard 2017 or equal shall be done in a laboratory listed configuration, if the software programming features can not provide a listed interface control. If field modification such as adding equipment such as relays, then the manufacturer of the panels being same or different brand of manufacturer shall provide the installing contractor for review and confirmation by the installing contractor. The installing contractor shall as part of his submittal documents provide this information.

### 2.2 SYSTEM OPERATION

The Addressable Interior FA/MNS shall be a complete, supervised, non-coded, analog/addressable system conforming to NFPA 72, UL 864 Ninth Edition, and UL 2017. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm

control panel is reset and restored to normal. The system maybe placed in the alert mode by local microphones or remotely from authorized locations/users.

#### 2.2.1 Functions and Operating Features

The system shall provide the following functions and operating features:

- a. Existing FACPs and FACUs provide power, annunciation, supervision, and control for the system.
- b. Existing initiating device circuits are Class A initiating device circuits.
- c. Existing addressable device signaling line circuits are Class A.
- d. Existing inter-panel signaling line circuits are class X.
- e. Existing notification appliance circuits are Class A.
- f. Alarm, supervisory, and/or trouble signals are automatically transmitted to the Ft. Detrick Fire Department.
- g. Receipt of an alarm from a manual fire alarm pull station shall automatically initiate the following functions:
  - (1) Transmit an alarm signal to the Fire Department.
  - (2) Visual indication of the device in alarm on the FACPs and GDU. The GDU shall display a floor plan of the building and graphically show the exact location of the device in alarm.
  - (3) Visual alarm notification appliances shall operate throughout the building. Audible alarm notification appliances shall sound the fire alert message throughout the building except in stairs and elevators. LED signs shall display the fire alert message.
  - (4) Record the event via the system printer and FACP history logs.
  - (5) Unlock delayed egress doors throughout the building.
- h. Receipt of an alarm from a sprinkler waterflow alarm switch shall automatically initiate the following functions:
  - (1) Transmit an alarm signal to the Fire Department.
  - (2) Visual indication of the sprinkler zone in alarm on the FACPs and GDU. The GDU shall display a floor plan of the building and graphically show the boundaries of the sprinkler zone served by the device in alarm.
  - (3) Visual alarm notification appliances shall operate throughout the building. Audible alarm notification appliances shall sound the fire alert message throughout the building except in stairs and elevators. LED signs shall display the fire alert message.
  - (4) Record the event via the system printer and FACP history logs.
  - (5) Unlock delayed egress doors throughout the building.

- i. Receipt of an alarm from a duct mounted smoke detector or from spot detectors mounted in front of return air system duct/shaft openings automatically initiates the following functions:
  - (1) Transmit a supervisory signal to the Fire Department.
  - (2) Visual indication of the device in alarm on the FACPs and GDU.  
The GDU displays a floor plan of the building and graphically show the location of the device in alarm. If the device in alarm is on a return air duct and located on a floor other than the floor served by the duct system, the GDU shall highlight the area served by the detector and not the detector itself.
  - (3) Record of the event via the system printer and FACP history logs.
  - (4) Unlock delayed egress doors throughout the building.
  - (5) Signal the Building Management System to shut down the affected supply and/or return air systems.
- j. Supervisory signal shall automatically initiate the following functions:
  - (1) Visual indication of the device operated on the FACP, and on the GDU shall display a floor plan showing location of supervisory device, and sound the audible alarm at the respective panel.
  - (2) Transmission of a supervisory signal to the fire department.
  - (3) Recording of the event via the system printer and in the history logs of the FACPs.
- k. A trouble condition shall automatically initiate the following functions:
  - (1) Visual indication of the system trouble on the FACP, and on the graphic annunciator, and sound the audible alarm at the respective panel.
  - (2) Transmission of a trouble signal to the fire department.
  - (3) Recording of the event via the system printer.

## 2.3 SYSTEM MONITORING

### 2.3.1 Sprinkler Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Each valve supervisory switch shall be provided with a separate address, unless they are within the same room and have related functions, and then a maximum of five can use the same address.

## 2.4 MASS NOTIFICATION SYSTEM FUNCTIONS

### 2.4.1 Notification Appliance Network

The notification appliance network consists of audio speakers located to provide intelligible instructions at all locations in the building. The Mass Notification System announcements shall take priority over all other function of the system including the audible and visual output of the fire alarm system in a normal or alarm state. All fire alarm system functions shall continue in an alarm state except for the output signals of the audible and visual notification appliances.

### 2.4.2 Strobes

Strobes are also provided to alert hearing-impaired occupants.

### 2.4.3 LED Signs

LED signs displays for hearing impaired occupants.

### 2.4.4 Door Operation

Closure of doors held open by electromagnetic devices.

### 2.4.5 Voice Notification

FACP is used to monitor and control the notification appliance network and provide facilities for manual operation. Using an FACP, personnel in the building can initiate delivery of pre-recorded voice messages, provide live voice messages and instructions, and initiate visual strobe and textual message notification appliances. When providing live voice messages, the audible appliances in the subzone from which the messages originate shall be muted to avoid feedback. Autonomous mass notification functions will temporarily override audible fire alarm notification while delivering Mass Notification messages.

## 2.5 OVERVOLTAGE AND SURGE PROTECTION

### 2.5.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41. Cables and conductors that serve as communications links shall have surge protection circuits installed at each end that meet the following waveform(s):

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

### 2.5.2 Sensor Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveforms:

- a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

### 2.6 ADDRESSABLE INITIATING DEVICE CIRCUIT INTERFACE

The initiating device circuits being monitored shall be configured as a Style D initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc. The module shall be UL listed or FM approved as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

### 2.7 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed.

### 2.8 ISOLATION MODULES

Provide isolation modules to subdivide each signaling line circuit into groups of not more than 20 addressable devices between adjacent isolation modules. The 20 addressable devices shall not be located on more than one floor.

### 2.9 SMOKE SENSORS

#### 2.9.1 Spot-Type Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

- a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke sensors shall be listed for use with the fire alarm control panel.
- b. Provide self-restoring type sensors that do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.
- d. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.
- e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of the low voltage type rated for use on a 24 VDC system.
- f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.
  - (1) Primary status
  - (2) Device type
  - (3) Present average value
  - (4) Present sensitivity selected
  - (5) Sensor range (normal, dirty, etc.)

#### 2.9.2 Duct Smoke Sensors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset

switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

#### 2.9.3 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with NFPA 72 and manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval.

#### 2.9.4 Self-Test Routines

Automatic self-test routines shall be performed on each sensor that will functionally check sensor sensitivity electronics and ensure the accuracy of the value being transmitted. Any sensor that fails this test shall indicate a trouble condition with the sensor location at the control panel.

#### 2.9.5 Operator Access

An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each heat sensor:

- a. Primary status
- b. Device type
- c. Present average value
- d. Sensor range

#### 2.9.6 Operator Control

An operator at the control panel, having the proper access level, shall have the capability to manually control the following information for each heat sensor:

- a. Alarm detection sensitivity values
- b. Enable or disable the point/device
- c. Control sensors relay driver output

### 2.10 ELECTRIC POWER

#### 2.10.1 Batteries

Provide sealed, maintenance-free, gel cell batteries as the source for emergency power to the FACP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

##### 2.10.1.1 Capacity

Increase the size of existing batteries if required as a result of added notification appliance loads so as to maintain sufficient capacity to

operate the system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and all audible and visual signal devices under alarm conditions for an additional 15 minutes.

#### 2.10.1.2 Battery Power Calculations

- a. Verify that battery capacity exceeds supervisory and alarm power requirements.
  - (1) Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period shall be included.
  - (2) Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.
  - (3) A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.
- b. For battery calculations use the following assumptions:

Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

#### 2.10.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

#### 2.11 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS

Any amplifiers, preamplifiers, tone generators, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed in a fire alarm control unit, terminal cabinet, or in the fire alarm control panel. The system shall automatically operate and control all building fire alarm speakers except those installed in the stairs and within elevator cabs. The speakers in the stairs and elevator cabs shall operate only when the microphone is used to deliver live messages. Each amplifier shall be single output channel.

##### 2.11.1 Construction

Amplifiers shall utilize computer grade solid state components and shall



be provided with output protection devices sufficient to protect the amplifier against any transient up to 10 times the highest rated voltage in the system.

#### 2.11.2 Inputs

Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

#### 2.11.3 Tone Generator

The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall produce a low (400 hertz) tone, and shall constantly alternate with the digitalized voice message. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

#### 2.11.4 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer, and other actions for trouble conditions as specified.

### 2.12 MANUAL STATIONS

Provide metal or plastic, semi-flush mounted, single action, addressable manual stations that are not subject to operation by jarring or vibration in normal locations. Stations noted as weatherproof shall be metal only suitable for outdoor use. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall have screw terminals for conductors.

### 2.13 NOTIFICATION APPLIANCES

#### 2.13.1 Fire Alarm/Mass Notification Speakers

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted white.

- a. Speakers shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 70 Vac, and 25 Vac, by means of selectable

tap settings. Tap settings shall include taps of 1/4, 1/2, 1, 2, and 8 watt. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400Hz to 4000Hz, and shall have a sealed back construction. Unless otherwise noted, speakers shall be capable of installation on standard 4 inch square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single wall mounted unit. All inputs shall be capacitor coupled for compatibility with standard DC supervision of circuit wiring.

- b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.
- c. Provide speakers listed for weatherproof applications where shown on drawings.

#### 2.13.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans With Disabilities Act (ADA). Fire Alarm/Mass Visual Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light and be marked "ALERT" in red letters. Strobe flash rate shall be 1 flash per second and a minimum UL 1971 candela rating as noted on drawings. Semi-flush mounted, unless otherwise noted. Provide synchronized operation.

- a. Provide units listed as weatherproof where shown on drawings.

#### 2.13.3 Sprinkler Alarm Gong

Surface mounted with the matching mounting back box suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of 90 dBA at 10 feet. Bells shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

#### 2.13.4 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

#### 2.14 NAMEPLATES

- a. Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

- (1) FACPs and FACUs
- (2) Radio Transmitter

(3) Printer

- b. Furnish to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.15 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.15.1 Alarm Wiring

The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 14 AWG size conductors at a minimum. Notification appliance circuit conductors shall be solid copper No. 14 AWG size conductors at a minimum. Wire size shall conform to equipment manufacturer's published documentation and shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING AND INDICATING DEVICES

- a. Manual Stations: Locate manual stations where shown on the drawings.
- b. Notification Appliances: Locate notification appliance devices as indicated and as required by NFPA 72. Ceiling mounted speakers shall conform to NFPA 72.
- c. Smoke and Heat Sensors: Locate sensors as indicated and as required by NFPA 72 and their listings.

3.2 SYSTEM FIELD WIRING

3.2.1 Wiring within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

3.2.2 Alarm Wiring

Provide all wiring in conduit. Voltages shall not be mixed in any

junction box, housing, or device, except those containing power supplies and control relays. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits to equipment mounted on movable surfaces such as ceiling tiles. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point that shall be in or adjacent to the FACP in Work Room 1NA102. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

### 3.2.3 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACPs, and FACUs shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

### 3.3 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

### 3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes conduit and surface metal raceways red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Testing Procedures

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard's Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be

used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

- a. Identify the NFPA Class and Style of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).
- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
- e. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

### 3.5.2 Tests Stages

- a. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- b. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Offices Designated Representative (COR).
- c. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer and the Army Corps of Engineers, Baltimore District, Fire Protection Engineer. The Contractor shall furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the job site:
  - (1) The systems manufacturer's technical representative
  - (2) Marked-up red line drawings of the system as actually installed

(3) Loop resistance test results

(4) Complete program printout including input/output addresses

- d. The final tests shall be witnessed by the Contracting Offices Designated Representative (COR). At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance.

### 3.5.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, IEC 60849, IEC 60268-16. The required tests are as follows:

- a. Verify the absence of unwanted voltages between circuit conductors and ground on added and modified circuits. The tests shall be accomplished at the preliminary test with results available at the final system test.
- b. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- c. Test each added and relocated initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.
- d. Test the system for specified functions related to the work of this contract in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- e. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- f. Determine that the system is operable under trouble conditions as specified.
- g. Visually inspect wiring.
- h. Test the battery charger and batteries.
- i. Verify that software control and data files have been entered or programmed into the FACPs and FACUs. Hard copy records of the software shall be provided to the Contracting Officer.
- j. Verify that red-line drawings are accurate.
- k. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- l. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- m. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

- n. Audibility Intelligibility testing of the Voice Evacuation Notification System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2.
- o. Open, ground and short added and modified circuits at not less than 10 percent of alarm initiating devices and notification appliances to test the wiring supervisory feature.

-- End of Section --

SECTION 31 00 00

EARTHWORK  
10/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only and represents the latest edition in force when this contract is awarded.

ACI INTERNATIONAL (ACI)

ACI 229R (2013) Controlled Low-Strength Materials

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (2017) Standard Method of Test for  
Moisture-Density Relations of Soils Using  
a 4.54-kg (10-lb) Rammer and a 457-mm  
(18-in.) Drop

AASHTO T 224 (2010) Standard Method of Test for  
Correction for Coarse Particles in the  
Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C109/C109M (2021) Standard Test Method for  
Compressive Strength of Hydraulic Cement  
Mortars (Using 2-in. or (50-mm) Cube  
Specimens)

ASTM C117 (2017) Standard Test Method for Materials  
Finer than 75-um (No. 200) Sieve in  
Mineral Aggregates by Washing

ASTM C127 (2015) Standard Test Method for Density,  
Relative Density (Specific Gravity), and  
Absorption of Coarse Aggregate

ASTM C128 (2015) Standard Test Method for Density,  
Relative Density (Specific Gravity), and  
Absorption of Fine Aggregate

ASTM C136/C136M (2019) Standard Test Method for Sieve  
Analysis of Fine and Coarse Aggregates

ASTM C33/C33M (2018) Standard Specification for Concrete  
Aggregates

ASTM D1140 (2017) Standard Test Methods for  
Determining the Amount of Material Finer



	than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2922	(2005) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2937	(2017; E 2017; E 2018) Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D3017	(2005) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D422	(1963; R 2007; E 2014; E 2014) Particle-Size Analysis of Soils
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE C95.4	(2002) Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual

## 1.2 DEFINITION

Basement: The term Basement as used herein refers to the Pipe Vault area and to the concrete utility corridor/tunnel to the SSP building.

### 1.3 MEASUREMENT AND PAYMENT

All work necessary to construct the project in accordance with the contract documents shall be covered by the lump sum bid except for features of work which are specifically covered by unit price payment items.

#### 1.3.1 Mass Rock Excavation

This unit price item covers the excavation of rock encountered during site grading, basement/tunnel excavation activities, and any other large excavation areas (i.e., as compared to narrow, confined excavation areas for utilities which is covered under a separate unit price item). Mass rock excavation shall be measured and paid for by the number of cubic yards of acceptably excavated rock material. In the basement/tunnel areas, payment will be made to a maximum distance of 3 feet beyond the edge of the mat measured horizontally from the edge of the mat. Payment shall be in accordance with unit price item 31 00 00-1 Mass Rock Excavation. Measurement for payment shall be computed by the average end area method from cross sections taken before and after the excavation. Payment shall constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work. Payment shall be made in addition to the lump sum bid, and shall include all necessary drilling and blasting and all incidentals necessary to excavate and dispose of the rock.

#### 1.3.2 Rock Excavation for Utilities

Rock excavation for Utilities shall be measured and paid for by the number of cubic yards of acceptably excavated rock material in utility excavations. Payment shall be in accordance with unit price item 31 00 00-2 Rock Excavation for Utilities. The material shall be measured in place, but volume shall be based on a maximum 30 inch width for pipes 12 inches in diameter or less, and a maximum width of 16 inches greater than the outside diameter of the pipe for pipes over 12 inches in diameter. The measurement shall include all authorized overdepth rock excavation as determined by the Contracting Officer. For manholes and other appurtenances, volumes of rock excavation shall be computed on the basis of 1 foot outside of the wall lines of the structures. Payment shall constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work. Payment shall be made in addition to the lump sum bid, and shall include all necessary drilling and blasting and all incidentals necessary to excavate and dispose of the rock.

#### 1.3.3 Dental Concrete

This unit price item covers "Dental Concrete" work required in excavations where directed by the Contracting Officer. Dental concrete work includes hand excavation of material from any soil filled seams/joints observed within the rock surface, cleaning of the rock surface and replacement of the excavated material with lean (2000 psi) concrete. Excavation will typically extend to twice the width of the seam/joint but final guidance shall be provided by the Contracting Officer based on the conditions observed. Dental concrete shall be measured and paid for by the number of cubic yards of soil excavated and replaced with lean concrete. The rock surface shall be cleaned prior to the placement of concrete. Payment shall be made in accordance with unit price item 31 00 00-3 Dental Concrete of the Unit Price Schedule, and shall include all necessary labor, materials, equipment, tools, supplies and incidentals necessary to

complete the work as described.

#### 1.3.4 Concrete Filling of Voids

This unit price item covers work required to fill voids in the exposed, finished rock subgrades where directed by the Contracting Officer. This unit price item does not cover work which is specifically identified to be covered under other unit price items. The work entails placement of a fluid concrete (minimum strength of 2000 psi) into observed voids in accordance with the direction of the Contracting Officer. Concrete slump and placement techniques (such as amount of vibration) shall be as directed. Filling of voids shall be measured and paid for by the number of cubic yards of concrete placed. Payment shall be made in accordance with unit price item 31 00 00-4 Concrete Filling of Voids of the Unit Price Schedule, and shall include all necessary labor, materials, equipment, tools, supplies and incidentals necessary to complete the work as described.

#### 1.3.5 Soil Removal and Replacement with Concrete

This unit price item covers work required where rock does not exist at the bottom of the basement and tunnel excavations indicated by the drawings. The work includes removal of soil below such drawing elevations to the rock surface and replacement with lean concrete (minimum strength of 2000 psi) when directed by the Contracting Officer. Soil removal and replacement with concrete shall be measured and paid for by the number of cubic yards of soil excavated and replaced with lean concrete. Payment shall be made in accordance with unit price item 31 00 00-5 Soil Removal and Replacement with Concrete of the Unit Price Schedule, and shall include all necessary labor, materials, equipment, tools, supplies and incidentals necessary to complete the work as described.

#### 1.3.6 Probe Holes in Basement Area

Probe holes shall be measured and paid for by the number of linear feet of rock probed. Measurement shall include all probe hole work performed at the direction of the Contracting Officer. Payment shall be made in accordance with unit Price item 31 00 00-6 Probe Holes in Basement Area. Payment will constitute full compensation for all labor, materials, equipment, tools, supplies and incidentals necessary to complete the work.

#### 1.3.7 Grouting of Voids

This unit price item covers work required to fill subsurface voids up to 20 feet below the finished rock subgrade in the basement area as directed by the Contracting Officer based upon observation of the basement core borings and probe holes. The work entails pressurized placement of a fluid grout into subsurface voids in accordance with the direction of the Contracting Officer. Mobilization and Demobilization of Grouting Equipment shall be paid for in accordance with unit price item 31 00 00-7 Mobilization and Demobilization of the Unit Price Schedule (price EA-each is combined total for mobilization and demobilization). Measurement and Payment for installation of grout pipes shall be made per linear foot of grout pipe installed in accordance with unit price item 31 00 00-8 Grout Pipe Installation of the Unit Price Schedule. Measurement and payment for injected grout shall be per cubic yard of material placed in accordance with unit price item 31 00 00-9 Grouting of Voids of the Unit Price Schedule. Costs for all ancillary items of work such as submittals, record keeping, quality control testing and all other items shall be included as

part of the unit price items discussed above. The unit price items discussed herein shall include all necessary labor, materials, equipment, tools, supplies and incidentals necessary to complete the work as described.

#### 1.4 DEFINITIONS

##### 1.4.1 Satisfactory Fill, Embankment and Backfill Materials

a. Satisfactory materials for Fill, Embankment, and Backfill shall comprise materials classified by ASTM D2487 as indicated below for the different areas of the project. Material requirements for areas labeled as structural fill on the drawings do not differ from the Satisfactory Materials requirements presented herein.

1. Backfilling of Excavations Behind Basement and Tunnel Walls: In these areas, materials shall meet classifications of SC, GC, or GW-GC.
2. Behind Other Retaining Walls and Shallow Pit Walls (<10' deep): In these areas, materials shall meet classifications of GM or GW-GM. These materials must be placed to a minimum 1:1 slope projected from the heel of the wall footing (for walls in cut areas must excavate on a minimum slope of 1:1 from the heel to meet this requirement). Additionally #57 stone should be used for a zone 1 foot behind the wall for the upper 3 feet of the wall to prevent excess residual pressures from compaction.
3. Areas Within Building Limits (except where otherwise specified): In these areas, materials shall meet classifications of SC, SW-SC, GM, GC, GW-GC.
4. Areas outside Building Limits (except where otherwise specified): SC, GC, CL, ML.
5. Below Mow Strips and Architectural Gravel Areas around the Building: A minimum thickness of 18 inches of CL or ML soils having a minimum plasticity index of 10 shall be placed below the surface gravel in these areas.
6. Around utilities: Flowable fill shall be used around all utilities which carry fluids as detailed in paragraph Bedding and Initial Backfill Material. Any requirement to encase utilities in concrete shall supercede the flowable fill requirement. Required dimensions of flowable fill around these utilities are defined later in this section. Backfill above the flowable fill or for utilities where flowable fill is not required shall meet the material requirements of preceding paragraphs based on location.
7. NMR Area and Confocal Microscope Area: Special materials are required below the NMR pit area and Confocal Microscope area. This includes a layer of Dense Graded Aggregate over a layer of flowable fill that extends down to rock. Refer to the specific requirements and extents shown on the drawings.

b. Except for a portion of the on-site soils meeting the CL and ML classifications above for use outside building limits, materials meeting the above requirements for fill, embankment and backfill are not available on site. The contractor shall therefore anticipate all

such materials shall be imported. In the areas outside building limits where CL and ML are allowed for use, the contractor should be aware of the possible construction difficulties and the very close moisture control required in the proper field placement and compaction of CL and ML materials. Satisfactory materials shall also be free of trash, debris, roots or other organic matter, or stones larger than 3 inches in any dimension.

#### 1.4.2 Satisfactory Subgrade Soils

Satisfactory soils for all subgrades shall consist of all subgrade soils, except as specified hereinafter in the paragraph UNSATISFACTORY MATERIALS, SUBGRADE.

#### 1.4.3 Unsatisfactory Fill, Embankment and Backfill Materials

Materials which do not comply with the requirements for Satisfactory Fill, Embankment and Backfill Materials are unsatisfactory. In addition, materials classified in ASTM D2487 as Pt, OH, and OL or combinations thereof are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

#### 1.4.4 UNSATISFACTORY MATERIALS, SUBGRADE

- a. Satisfactory subgrade soils which are rendered unsuitable by the contractor due to inadequate site and/or excavation drainage or due to the negligence by working (remolding) or compacting otherwise satisfactory in place subgrade soils under adverse moisture conditions shall be removed and replaced with satisfactory fill material or shall be worked or altered until rendered suitable as determined by the Contracting Officer.
- b. Unsatisfactory materials for subgrades shall be those materials classified in ASTM D2487 as Pt, OH, OL or combinations thereof. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and materials which contains roots and other organic matter, frozen material, and stones larger than 3 inches.

#### 1.4.5 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D4318, ASTM C136/C136M, ASTM D422, and ASTM D1140.

#### 1.4.6 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Procedure C abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30

percent by weight of their particles retained on the 3/4 inch sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

#### 1.4.7 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

#### 1.4.8 Bedding and Initial Backfill Material

For water, roof drain, sanitary, storm drain and any other utility lines which will carry fluids, flowable fill must be used for bedding and initial backfill. Flowable fill materials shall be placed to a minimum of 4 inches below the bottom of the pipe (6 inches for pipes greater than 1 foot diameter) the same distance on either side of the pipe and to a minimum of 12 inches above the top of the pipe. The depth of flowable fill above the pipe may be reduced to 6 inches when necessary due to a limited distance between the pipe and the bottom of the building slab. Bedding and initial backfill for other utilities shall consist of satisfactory materials as defined in this specification. Gravel bedding such as #57 stone shall not be used. Satisfactory backfill materials around any utilities with corrosion protection shall have a maximum particle size of 1 inch or as recommended by the pipe manufacturer, whichever is smaller.

#### 1.4.9 Flowable Fill

Flowable fill for use as bedding and initial backfill shall meet the requirements of ACI 229R Controlled Low Strength Material. The 28 day compressive strength shall be between 50 psi and 100 psi. The mix shall use fine aggregate. Coarse aggregate shall not be used. The contractor shall submit a report including test data 30 days prior to placement showing that the proposed mix will meet the requirements. The test results data shall be less than 6 months old. Strength testing shall be from testing of molded cubes 2 inch square in accordance with ASTM C109/C 109M. Test data shall include both 7 day and 28 day strength information. Tests for strength shall also be taken during construction for every 50 cubic yards of material placed.

#### 1.4.10 Final Backfill Material for Utilities

Final backfill material shall consist of Satisfactory Backfill Materials.

### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-05 Design Data

Shoring and Sloping in Basement Areas; G, ED  
Plans and calculations of shoring and/or sloping systems to be used in basement areas. System designs shall be performed by a

## Repair Steam Sterilization Plant (SSP)

Registered Professional Engineer.

Dewatering; G, AR

Notification prior to performing any dewatering activities.

Discontinuing Dewatering Notification; G, AR

Notification and Contracting Officer approval prior to discontinuing dewatering in the basement area. Refer to paragraph Dewatering Duration in the Basement Area.

Dewatering Plan; G, ED

Copies of plans and calculations for approval not less than 45 days before installation

Blast Monitoring Plan; G, ED

Copies of blast monitoring plan for approval not less than 45 days before first blast event

Pre-blast Survey Report; G, AR

Copies of preblast survey reports not less than 30 days before first blast event

Blasting Schedule; G, AR

Notification with proposed blasting schedule at least 2 weeks prior to blasting. Required notifications and information as discussed herein 24 hours and 1 hour in advance of any blasting.

Seismograph and Air-Blast Records; G, AR

Seismograph (velocity-frequency) and air-blast records from each blast-monitoring device for each blast shall be provided for Information to the Contracting Officer within 24-hours after each respective blast.

Blasting Safety Plan; G, ED

Blasting Safety Plan at least 30 days prior to performing the work.

Post Blast Reconnaissance; G, ED

After each blast, the contractor shall submit a documented post-blast reconnaissance which reviews the monitoring data and makes appropriate adjustments for subsequent blasts.

Blast Records

Copies of blast records shall be submitted within 24 hours of the completion of the blast

### SD-06 Test Reports

Core Borings; G, ED

Boring Logs and samples. Core Borings shall not be terminated and backfilled until approved by the Contracting Officer.

Basement Subgrade Inspection Notification

Notification for inspection of Basement subgrades. Inspection is required upon initial completion of the excavation and upon completion of any additional work/treatment directed by the Contracting Officer. No construction shall be performed on the finished subgrade until approved by the Contracting Officer's Geotechnical Engineer.

## Repair Steam Sterilization Plant (SSP)

### Testing

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

### Rock

Notification of encountering rock in the project during excavation.

### Mix Design for Grouting of Voids; G, ED

A mix design for the project indicating sources and types of grout materials, with volumetric proportions, and field test data from previous projects indicating compressive strength and slump.

### Grouting Records; G, ED

Accurate daily records of all grout pipe installation, grout volumes, pressures and depths for each grout pipe location.

### Contractor's Geotechnical Engineer's Reports;

Monthly reports required herein from the Contractor's Geotechnical Engineer during basement construction.

## SD-07 Certificates

### Testing Lab

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

### Grouting Contractor Qualifications

Qualifications and documentation showing the contractor has been engaged in specialized grouting work on similar projects for minimum of 5 years. Documents that demonstrate successful performance on these projects within the last 5 years.

### Flowable Fill; G, ED

Initial test results showing that the material meets the strength requirements 30 days prior to use.

### Flowable Fill

Strength tests during construction.

## 1.6 SUBSURFACE DATA

A subsurface investigation has been performed at the site by the Government and logs for the borings are presented in the contract drawings. Logs from investigative coring performed at a portion of the drilled pier locations are appended to the Specifications. While the conditions presented are representative of subsurface conditions at the respective locations, local variations in the characteristics of the subsurface materials may be anticipated. Local variations which may be encountered include, but are not limited to, classification and thickness of soil strata, classification and thickness of rock strata, fractures, and other discontinuities in the rock structure. Soil and Rock core samples from the subsurface investigation (except those used up during laboratory testing) are available for inspection by all bidders as indicated in the Job Conditions specification. The project geotechnical report is also available for inspection as indicated.

## 1.7 CLASSIFICATION OF EXCAVATION

Excavation specified shall be done on a classified basis, in accordance



with the following designations and classifications.

#### 1.7.1 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation. Costs for all common excavation shall be included in the lump sum bid.

#### 1.7.2 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be dislodged by a Caterpillar 345D hydraulic excavator or equivalent without the aid of drilling and blasting. Rock excavation includes only removal of natural rock materials and does not include demolition and removal of structures, concrete, or other man-made materials. Excavation of the material claimed as rock shall not be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer.

#### 1.7.3 BLASTING

Blasting will be permitted and related requirements are presented herein.

#### 1.8 SPOIL AREAS

Spoil materials shall be disposed of in spoil areas located outside the limits of Government-controlled land at the Contractor's expense and responsibility.

#### 1.9 BORROW AREAS

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained from approved sources outside the limits of Government-controlled land at the Contractor's expense and responsibility. The Contracting Officer shall be notified sufficiently in advance prior to opening any borrow area.

### PART 2 PRODUCTS

#### 2.1 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

##### Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other

Warning Tape Color Codes

Communications

Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

2.1.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.1.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.3 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel. The material shall conform to ASTM C33/C33M #57 coarse aggregate.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Areas of work shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, any utility lines, structures or other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING, BACKFILLING AND COMPACTION. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility as indicated in paragraph Spoil Areas. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the

Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 00 00, ADMINISTRATIVE REQUIREMENTS and Section 01 57 20.00 10, TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

### 3.2 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to its full depth. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be disposed of as indicated in paragraph Spoil Areas; however, written permission from the Contracting Officer is required prior to disposal of topsoil materials.

### 3.3 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in the spoil areas indicated in paragraph SPOIL AREAS. Unsatisfactory excavated material shall be disposed of in the spoil areas indicated in paragraph SPOIL AREAS. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be obtained as indicated in paragraph Borrow Areas. The Contracting Officer shall be notified when any rock is encountered in the excavation. Special inspections, approvals and treatments of subgrades in the basement area are required as indicated in the drawings and specifications.

#### 3.3.1 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed and the subgrade inspected and approved by the Contracting Officer's Geotechnical Engineer. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

#### 3.3.2 Trench Excavation Requirements

The trench shall be excavated as indicated on the drawings or as

recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. When not indicated on the drawings or recommended by the pipe manufacturer, the trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

#### 3.3.2.1 Bottom Preparation

For utilities which will carry fluids, flowable fill shall be used as indicated in paragraph Bedding and Initial Backfill Material. For other utilities, the bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

#### 3.3.2.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed to the level indicated on the contract drawings or to 4 inches below the required grade when not indicated on the contract drawings and replaced with satisfactory materials.

#### 3.3.2.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with satisfactory materials. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

#### 3.3.2.4 Removal of Unsatisfactory Material

Unsatisfactory material encountered beyond the depths indicated shall be removed to the depths and lateral limits directed by the Contracting Officer and replaced with satisfactory materials; payment therefore will be made in accordance with the CHANGE clause of the CONTRACT CLAUSES. Determination of elevation of approved overdepth excavations shall be done in the presence of the Contracting Officer.

### 3.3.2.5 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. If rock is encountered the Contracting Officer shall be notified, the rock inspected and any rock preparation measures performed as directed by the Contracting Officer (refer to Rock Inspection paragraph herein). Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

### 3.3.2.6 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

### 3.3.3 Underground Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

## 3.4 ROCK INSPECTION

In all areas, the Contracting Officer must be notified when rock is encountered. Cross-sectioning of the undisturbed rock for quantity measurement is required in the presence of the Contracting Officer. The Contracting Officer's Geotechnical Engineer must also approve the final rock subgrade prior to any filling or construction thereon. Special inspections are required for subgrades in the basement area.

## 3.5 BASEMENT SUBGRADE INSPECTIONS, TREATMENTS AND APPROVALS

Discussion of the basement area in the sub-paragraphs below generally refers to the main basement area and the associated concrete utility corridor/tunnel to the SSP building.

### 3.5.1 Core Borings

Prior to excavation for the basement area, core borings shall be performed for rock evaluation purposes. The locations of these core borings are shown on the drawings and generally correspond to areas of concentrated

load such as columns which extend to the basement mat and walls. The borings will be required to extend at least 20 feet below the basement subgrade elevation at the boring location (i.e., 20 feet below the bottom of the concrete mat). Borings shall not end in a void and must extend 5 feet beyond any voids. Borings shall extend deeper as directed by the Contracting Officer based on the conditions observed and backfilling of holes shall not be performed until directed. Except as otherwise indicated, procedures, payment, records, samples, logs and backfilling for the core borings shall be the same as indicated for Rock Evaluation Coring in the Drilled Pier specification. Information from the core borings will be used by the Contracting Officers engineer, in combination with inspections of the finished subgrade to determine the need and procedures for any rock subgrade treatments or additional excavation.

### 3.5.2 Inspections

Finished subgrades in the basement area must be inspected and approved by the Contracting Officer's Engineer prior to any construction thereon. Such inspection will include a visual inspection and observation of probe holes.

### 3.5.3 Subgrade Clean-Up

The Basement and Corridor/Tunnel mat foundations must bear on Rock. The Finished Subgrade on rock within shall be cleaned of all loose rock and soil material and shall consist of clean sound rock. The Contractor shall clean the finished subgrade using compressed air, picks, shovels, or other hand tools as necessary to remove all rock fragments, rock flower, soil, mud or any other loose material. Fractures or voids shall be cleared of soil and rock fragments and grouted as directed the Contracting Officer and specified herein. The contractor shall anticipate the extensive required use of hand tools and labor to provide the required finished subgrade surface. Prior to construction of the concrete mud slab (discussed subsequently), the Contracting Officer's Engineer shall inspect and approve the rock finished subgrade after receiving the Basement Subgrade Inspection Notification submittal.

### 3.5.4 Probe Holes

After excavation to the finished subgrade level in the basement area and subsequent cleanup of the excavation, the contractor shall perform probe holes at the locations and to the depths directed by the Contracting Officer with a rock drill/air hammer. It is anticipated that one hole will be performed near each core boring (i.e., areas of concentrated load on basement mat as discussed in previous paragraph core boring) and additional holes will be performed based on the observations of the Contracting Officer's Geotechnical Engineer. Holes will extend to a minimum depth of 6 feet below the proposed finished subgrade and deeper if so directed by the Contracting Officer. Holes shall be 1.5 inches to 2 inches in diameter. The contractor shall also provide the Contracting Officer with a "feeler rod" a minimum of 10 feet in length. The rod shall be a steel bar with the end of the bar bent and tapered (specifics of the rod will be given to the contractor during construction). The rod will be used to scrape the sides of the probe hole to identify the presence/angle of voids, fractures, etc for use in determining the acceptability of the subgrade. Payment for probe holes shall be in accordance with the associated unit price item. Probe holes shall be backfilled with neat cement grout in the same manner as specified for core holes in the drilled pier specification.

### 3.5.5 Treatment and Approval

After completion of all inspections, the Contracting Officer will direct any treatment measures required for the finished subgrades. Such measures may include work such as additional excavation, dental concrete, filling of voids with concrete, grouting of voids or other similar work. Payment for any such work directed by the Contracting Officer shall be in accordance with applicable unit price items included in the contract. Where unit price items do not exist for the work directed, payment shall be in accordance with the CHANGES clause of contract. After completion of such work, the Contracting Officer's Geotechnical Engineer must approve all finished subgrades prior to any construction thereon.

### 3.5.6 Concrete "Mud" Slab

After completion of any directed work and final approval of the finished subgrades, a mud slab shall be placed upon the finished basement subgrades. The mud slab shall consist of lean concrete having a minimum compressive strength of 2000 psi and meeting all requirements of the CAST-IN-PLACE STRUCTURAL CONCRETE specification. The mud slab shall be reinforced with 6" x 6" W2.9 x W2.9 welded wire mesh. The lean concrete shall be a minimum of 4 inches thick and thicker as necessary to provide a level, uniform, platform that is suitable for subsequent construction of the waterproofing and structural systems. The lean concrete shall be placed in intimate contact with the subgrade surface and shall be placed with the subgrade in a saturated, surface dry condition.

## 3.6 GROUTING IN THE BASEMENT AREA

### 3.6.1 General

The work described herein entails pressurized placement of a fluid grout into subsurface voids up to 20 feet below the finished rock subgrade in the basement area in accordance with the direction of the Contracting Officer. Grouting will only be required as determined by the Contracting Officer based on conditions observed in core holes and probe holes. No equipment for grouting shall be mobilized or work performed until directed by the Contracting Officer. Grout slump/consistency and placement techniques (pressures, etc) shall be as directed and as appropriate for the conditions observed.

### 3.6.2 Qualifications

The grouting program, including installation of grout pipes, shall be performed by a specialist grouting contractor with at least 5 years of documented experience in grouting.

### 3.6.3 Grouting Equipment

The grouting contractor shall supply equipment capable of advancing the grout pipe through rock to allow installation of grout to meet the project objectives. Equipment shall be provided to supply the specified grout at variable flow rates and pressures, as required to suit the application. Gauges or other instrumentation shall also be provided to measure grout pressures, flow rates and volumes.

### 3.6.4 Materials and Installation

Specifics of the grouting program such as grout pipe spacing/depth and grouting pressures and mix consistency will be determined during construction. These specifics will be determined through discussion of the specialty contractor with the Contracting Officers Geotechnical Engineer to accomplish the desired void filling based on the conditions observed in the core holes and grout holes. Grout pipes and connections shall be steel of adequate strength to withstand the required installation and pumping stresses. Installation shall be such that grout material will not travel in the annulus area between the pipe and adjacent ground and escape at the surface when pumped. Grout shall be a mixture of Portland Cement (ASTM C150) and fine aggregate and shall have a minimum compressive strength of 2000 psi unless otherwise approved. Natural fines may be supplemented with fly ash, bentonite, or aggregate washings. Proportions of the mixture shall be as required to achieve a pumpable mix that adequately fills voids as determined by the Contracting Officer. The contractor's mix design shall be submitted for approval. The Contractor shall record and submit daily records of grout pipe installation, grout volumes, pressures and depths for each grout pipe location. Checks on grout strength and consistency (slump or flow cone) shall be performed as necessary to ensure a consistent mix. At a minimum Slump (or flow cone) tests shall be performed once per day and strength tests shall be performed for each 25 cubic yards of material and if there are any changes in the mix design.

## 3.7 DRAINAGE AND DEWATERING

### 3.7.1 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely, continuously, and effectively drain the construction site and area immediately around the site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain effectively drained soils. Water shall not be permitted to accumulate in excavations. Excavations shall be drained by pumping or other satisfactory methods to prevent softening of the subgrade or other actions detrimental to proper construction procedures. Surface water shall be directed away from excavation and construction sites so as to prevent erosion. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

### 3.7.2 Dewatering

#### 3.7.2.1 Permits

The contractor shall be responsible for obtaining all permits related to his dewatering system including but not limited to: Maryland Department



of the Environment (MDE) "Application to Appropriate and use Waters of the State" and MDE Well Construction Permit (and subsequent related Well Completion Form and Well Abandonment Forms).

### 3.7.2.2 General

The contractor shall note the subsurface water level recorded and date when this level was recorded on the boring logs shown on the contract documents. These water levels are only for the dates shown on the logs and it can be expected that the water table may fluctuate to some extent.

### 3.7.2.3 Requirements

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, to allow construction as shown in the contract documents, and to eliminate interference with orderly progress of such construction. While the excavation is open, the water level shall be maintained continuously below the working level. In the basement area, dewatering activities must be continued beyond completion of work in the excavated area due to uplift considerations as discussed in the following paragraph. The Contracting Officer shall be notified before beginning any dewatering operations. The Contractor shall provide such temporary structures and systems, wells, pumps and other equipment of the type, capacity and strength as may be necessary for dewatering the work areas. The contractor will be required to provide suitable protection to any excavated areas to ensure that the fine-grained soils are not removed during the pumping operations. The contractor's anticipated methods of dewatering including plans and calculations should be submitted in the Dewatering Plan for approval at least 45 days prior to dewatering operations. Approval of such plans by the Contracting Officer will not relieve the Contractor of the responsibility for the adequacy thereof. All holes for wells, piezometers and other similar features of the dewatering system shall have all casings/screens removed and shall be fully grouted with a minimum 4000 psi grout upon completion of dewatering operations.

### 3.7.3 Dewatering Duration in the Basement Area

The basement structure is designed to withstand groundwater uplift pressures only after sufficient countering load from backfilling is in place (and until backfilling around and over the tunnel is in place). The groundwater level must therefore continue to be maintained below the basement floor elevation until the following has been completed: 1) The basement structure must be complete and backfilling performed to within 2 feet of finished grade. Groundwater must also be maintained below the tunnel area until backfilling is complete. Dewatering shall not be discontinued until approved by the Contracting Officer. The contractor shall be fully responsible for maintaining groundwater levels to prevent uplift. Should the contractor have any doubt as to the ability of his system to control groundwater in all situations, he will be required to have a contingency plan to address any "emergency measures" required in the event of an uncontrollable rise in groundwater. Such contingency measures will depend upon the specifics of the contractor's systems but might include items such as intentional flooding of the interior of the basement to offset uplift pressures. Systems shall be installed to accurately monitor groundwater levels and such systems shall be included in the contractor's dewatering submittal. All related plans shall be included in the dewatering submittal.

### 3.8 BLASTING VIBRATIONS

Vibration sensitive activities (such as electron microscope scanning and work with animals) are performed within buildings near the site. Special requirements for any blasting operations are therefore discussed in subsequent paragraphs. As indicated in such paragraphs, coordination will be required through the Contracting Officer with the building tenants and blasting should not be performed while activities such as electron microscope scanning are being performed. Additionally, blasting should not be performed in any areas where potential damage could occur to utilities with higher risk factors such as laboratory sanitary sewer lines (discuss purpose of utilities and potential risks with Ft. Detrick and Contracting Officer). Additionally, special requirements apply to blasting in relation to drilled piers as discussed in the Sequence of Work portion of the Drilled Pier specification.

### 3.9 BLASTING

#### 3.9.1 General

- a. **ALL BLASTING RELATED SUBMITTALS REQUIRE REVIEW OF BOTH THE CORPS OF ENGINEERS AND FT. DETRICK. SUBMITTAL PROCEDURES SHALL BE DISCUSSED WITH THE CONTRACTING OFFICER AT THE START OF THE PROJECT.**
- b. Blasting shall be permitted for excavation, as approved by the Contracting Officer. The Contractor shall comply with all requirements as set forth in EM 385-1-1. In addition, the Contractor shall comply with all other federal, state, and local regulations that apply to all aspects of explosives and blasting. The Contractor shall also comply with all of the following requirements.

#### 3.9.2 Purpose Of Blasting

Blasting shall be used to shatter the rock in place to permit removal by excavators.

##### 3.9.2.1 General Requirements

In blasting for the excavation, the contractor is required to execute a blasting program that minimizes overbreak, noise, vibration, and flyrock. In general, the contractor is required to: (1) minimize the explosive load per hole to break the rock; (2) initiate a small number of holes per blast; (3) deck through mud seams in the rock; (4) utilize sequential MS delays to initiate the blast; (5) utilize water gel explosives or similar explosives that are not sensitive to hole-to-hole propagation (bulk loaded explosive shall not be allowed); and (6) use blasting mats to control flyrock. Only small areas shall be fired at one time and the fragmented material shall be removed before the next blast. If a large shot is required, a sequential blasting machine shall be used to minimize the explosive weight per delay.

##### 3.9.2.2 Special Requirements

Blasting requires trained, skilled, and experienced personnel. This work shall be performed by a specialty contractor experienced in performing such work. At least five-years of experience performing work on similar type project is required. The Blaster must have a valid and current Explosives Blasters License issued by the State of Maryland.

### 3.9.2.3 Non-Blasting Areas

The Contracting Officer may designate small areas where blasting shall not be permitted. Those areas may include rock that is located immediately adjacent to existing structures, buildings, manholes, lateral sewer connection points, etc. Mechanical rock excavation methods, such as boom mounted hydraulic impact hammers, shall be used by the Contractor to excavate this rock.

### 3.9.3 Pre-Blast Meeting

The Blasting contractor is required to attend a pre-blast meeting to discuss work features and tasks. The meeting shall be scheduled after completion of the pre-blast survey report and at least 2 weeks prior to any blasting.

### 3.9.4 Explosive Storage

Storage and transportation of explosives shall comply with all prescribed federal regulations and in full accordance with all applicable State of Maryland requirements. ON SITE OVERNIGHT STORAGE OF EXPLOSIVES IS NOT AUTHORIZED. The Contractor shall bring onto the post only the quantity of explosives required for that particular workday. Explosives shall be contained on the transport vehicle that is in full compliance with Department of Transportation requirements. The Contractor shall be required to coordinate blasting operations in advance to avoid problems with radio operation.

### 3.9.5 Blasting Program

#### 3.9.5.1 Precautions

The Contractor shall take all precautions necessary to prevent damage to excavations, structures, and utilities and to prevent personal injury, damage to real or personal property, or interference with use and enjoyment of any property resulting from blasting or the vibration or concussion caused by blasting in the performance of this contract.

#### 3.9.5.2 Pre-Blast Survey

- a. The Contractor is required to perform a pre-blast survey of all structures within 300 feet of the blasting permit area. Copies of the pre-blast surveys shall be furnished to the Contracting Officer. The contractor shall coordinate with the Contracting Officer to acquire the necessary access to structures for the survey.
- b. The pre-blast survey shall be performed by an independent, qualified, and experienced (five-year minimum experience performing equivalent pre-blast surveys) blast-monitoring engineer hired by the contractor.
- c. The pre-blast survey shall determine the condition of the dwelling or structure and document pre-blasting damage, type of laboratory equipment and instruments located within the building, and other physical factors that could reasonably be affected by the blasting. Assessments of structures such as pipes, cables, transmission lines and wells and other water systems shall be limited to surface condition and readily available data. Pre-blasting conditions of wells and other water systems used for human, animal or agricultural purposes shall be ascertained to the extent possible regarding the

quantity and quality of the water. A written report of the survey shall be prepared and signed by the person who conducted the survey. The report may include recommendations of special conditions or proposed adjustments to the blasting procedure which should be incorporated into the blasting plan to prevent damage. Copies of the report shall be provided promptly to the Contracting Officer. No Blasting shall be performed until approval of the Pre-blast Survey by the Contracting Officer.

### 3.9.5.3 Blast Monitoring Plan

- a. The Contractor shall submit a Blast Monitoring Plan for Government approval prior to blasting. The blast monitoring shall be performed by an independent, qualified, and experienced (five-year minimum experience) blast-monitoring engineer hired by the contractor. The blast-monitoring plan shall be prepared by the blast-monitoring engineer. The blast-monitoring plan shall contain, as a minimum, the name, address, and telephone number of the blast-monitoring engineer; data on the monitoring equipment that shall be used to monitor the ground motions and air blasts; methods of installing transducers; recommended monitoring locations; location of critical buildings and facilities; etc.
- b. The blast-monitoring engineer shall monitor and permanently record each blast with equipment capable of recording both seismic (particle-velocity and vibration-frequency) and air pressure events. The blast monitoring equipment shall be fully capable of performing peak, USBM, and OSMRE field frequency analyses over a frequency range of 2 to 100 HZ. The Contractor shall submit to the Contracting Officer the Manufacturer's data for this equipment. At a minimum, the equipment shall be capable of recording the three components of ground vibration over a particle velocity range of at least 0.02 to 4.0 inches per second and a frequency range of 2 to 250 Hz. The equipment shall also record the blast event so as to permit preparation of a blast vibration record to confirm compliance with the ground vibration requirements specified herein. The equipment shall be capable of recording air overpressure up to at least a 140-dB peak. At least three (3) blast-monitoring devices are required to record each blast.
- c. Blast vibrations shall be recorded at all structures (including buildings, utilities and other constructed features) within 300 feet of the work or the closest structure. Additionally, monitoring shall be performed at the closest drilled pier if any drilled piers are constructed prior to the blasting (refer also to drilled pier spec for further related requirements). The peak particle velocity as defined by any component of the particle velocity seismograph shall be less than 2 inches per second. Air blast (air concussion) pressure exerted on structures resulting from blasting shall not exceed 133 dB (0.013 psi). When blasting adjacent to utilities or pipelines the peak particle velocity shall be less than 5 inches per second. If blasting beneath a utility or pipeline is required, the contractor shall support and protect the utility or pipeline from blast damage or damage caused by blast induced ground movements. Additionally, blasting should not be performed in any areas where potential damage could occur to utilities with higher risks such as laboratory sanitary sewer lines (discuss purpose of utilities and potential risks with Ft. Detrick and Contracting Officer). The contractor shall be responsible for repair or replacement of any utilities or pipelines that are either directly or indirectly damaged by blasting operations. A copy

of all blast monitoring records from a single blast shall be furnished to the Contracting Officer prior to the next blast commencing.

- d. A minimum of three monitoring locations shall be established for each blast unless otherwise directed by the Contracting Officer. Monitoring locations will be selected by the Contractor and subject to approval by the Contracting Officer. A seismograph (velocity-frequency) and air-blast record shall be provided from each blast-monitoring device for each blast.

#### 3.9.5.4 Blasting Safety Plan

The Contractor shall submit for Government approval a detailed Blasting Safety Plan. As a minimum, the blasting safety plan shall list the names, qualifications, and responsibilities of personnel involved with explosives and blasting; delineate the contractors requirements for handling, transporting, and daily storage of explosives; methods for securing the explosives; vibration and damage control; post-blast inspection and misfire procedures; and post-blast ventilation requirements. Also included in this plan shall be information resulting from investigations to establish limits of the size and nature of individual blasts, which may be safely accomplished without property damage, excess ground vibration or air-blast, or personnel injury. The plan shall specify explosive products to be used to include all manufacturers' data. The plan shall detail all general loading and firing procedures, as well as, address all safety issues to control the site and provide adequate warning to the surrounding area. The blasting plan shall become part of the site safety plan and shall be communicated to all site personnel.

#### 3.9.5.5 Post Blast Reconnaissance

After each blast, the contractor shall submit a documented post-blast reconnaissance which reviews the monitoring data and exposed sidewalls after removal of blasted material and makes appropriate adjustments for subsequent blasts. In addition, adjacent structures and equipment shall be surveyed and compared to the pre-blast survey to ensure damage has not occurred. The post-blast reconnaissance will be reviewed and approved by the Government prior to the next blast. Subsequent blasting shall not commence until review of recommendations in the post-blast reconnaissance by the Contracting Officer.

#### 3.9.5.6 Modification of Blasting

If personal injury, damage to real or personal property, or interference with the use of any property results from blasting or from excess ground vibration or air concussion caused by blasting done under this contract, the Contractor shall modify his blasting procedures, as approved by the Contracting Officer, to minimize such damage, excess ground vibration, or air concussion in subsequent blasting operations. No payments will be made for varying blasting techniques to achieve compliance with this requirement.

#### 3.9.5.7 Misfires

The Contractor shall be required to notify the Contracting Officer immediately if a misfire occurs.

#### 3.9.5.8 Liability/Regulations

The Contractor hereby assumes all liability for all personal injury, and damage to real or personal property, or interference with the use or enjoyment of any property by reason of blasting or the resulting vibration or concussion. The Contractor assumes full responsibility for operating all equipment and performing all blasting in conformance with federal or state laws and regulations prescribed by any other Governmental authority with jurisdiction in this area limiting the amount of ground vibration or air concussion.

#### 3.9.6 Blasting Schedule

- a. Blasting schedules shall be submitted at least 2 weeks in advance of any blast. Schedules will require approval of both the Corps of Engineers and Ft. Detrick. Coordination of schedules will also be required with nearby building tenants through the Contracting Officer to ensure that blasting does not occur while vibration sensitive activities (such as electronic microscope scanning) are being performed. The contractor's submission shall detail the schedule of blasting operations with specific dates and times. Schedules shall also be discussed at the pre-blast meeting.
- b. All blasting shall be conducted between the hours of 8:00 AM and 4:30 PM unless otherwise approved by the Contracting Officer. In addition to the two week notification, the Contractor shall again supply the Contracting Officer with a detailed schedule of blasting at least 24 hours prior to each blast. The Contractor shall verbally notify the Contracting Officer approximately one-hour prior to initiating any blast.
- c. The blasting schedule shall contain the name, address, and telephone number of the blaster; an identification of the specific areas in which blasting shall take place over the next 24 hours; dates and time periods when explosives are to be detonated; method used to control access to the blast area; methods of blast initiation; and information on the types and patterns of audible warnings and all-clear signals that shall be used by the blaster.
- d. In addition, the blasting schedule shall contain, on a form approved by the Contracting Officer, data on the proposed location, depth, pattern, and inclination of the blast holes; the type, strength, amount, distribution, and powder factor for the explosives used per hole and pre-blast; the scaled distance, based upon the distance from the nearest structure to the blast site and the weight of explosives per delay; the sequence and pattern of delays; and the description and purpose of special methods to be used.

#### 3.9.7 Blasting Procedures

- a. Blasting shall be done only to such locations and with explosives for such quality, distribution, and density as will not damage the rock beyond the prescribed excavation limits as shown on the Contract Drawings.
- b. Blasting shall begin in an area designated by the Contracting Officer. This area shall be away from critical facilities that are sensitive to vibration and noise. Blasting shall only proceed to critical areas after satisfactory control over vibration, noise,

overbreak, and flyrock are achieved.

- c. The final rock surfaces shall be approved by the Contracting Officer before beginning any follow on construction. If, in the opinion of the Contracting Officer, satisfactory surfaces are not being produced, the blasting procedures shall be adjusted to the satisfaction of the Contracting Officer. Should any damage occur at or below the specified grades, as determined by the Contracting Officer, damaged materials shall be removed and conditions repaired as directed by the Contracting Officer at no additional cost to the Government. No additional payment will be made for varying blasting techniques to achieve a satisfactory surface, rock trimming, or disposal of excavated rock, and all costs therefore shall be considered incidental to the contract.
- d. The loading of all holes shall be in the presence of the Contracting officer.
- e. Under no circumstance shall blasting be performed within 100 feet of concrete which has been in place less than 7 days.
- f. The contractor shall provide a suitable audible warning system when blasting and post applicable warning signs.
- g. Electric initiating devices shall be utilized unless otherwise approved by the Contracting Officer. When blasting at a distance less than those shown in ANSI/IEEE C95.4 tables, an approved non-electric initiation system shall be used by the Contractor.
- h. All blasts shall be covered with adequate blast mats unless otherwise approved by the Contracting Officer.
- i. Controlled blasting techniques such as presplitting may be used by the Contractor to control overbreak.
- j. All blast holes will be stemmed with clay or screened dirt to control noise and flyrock, unless otherwise approved by the Contracting Officer.
- k. Blast Records: A record of each blast shall be kept. A copy of all records shall be furnished to the Contracting Officer. A copy of the records shall be furnished to the Contracting Officer within 24-hours after the blast. The original records shall be retained by the Contractor. The records shall contain the following minimum data:
  - 1. Name of company or contractor.
  - 2. Location, date, and time of blast.
  - 3. Name, signature, and license number of blaster in charge.
  - 4. Type of material blasted.
  - 5. Number of holes, burden, and spacing.
  - 6. Diameter and depth of holes.
  - 7. Types of explosives used.

8. Total amount (lbs.) of explosives used.
9. Maximum amount of explosives per delay period of eight milliseconds or greater.
10. Method of firing and type of circuit.
11. Direction and distance in feet to nearest structure and each monitoring location.
12. Scaled distance,  $\text{ft/lb}^{1/2}$  units (allowable charge weight of explosives detonated in any 8-millisecond period and as measured at the nearest structure).
13. Weather conditions.
14. Direction of wind.
15. Length and type of stemming.
16. Location and type of mats used.
17. Type of blasting caps and delay periods used.
18. Powder factor (lb./cu. yard).
19. Top and bottom elevation of the drill holes.
20. Distribution of charges placed within each hole.

### 3.10 SELECTION OF BORROW MATERIAL

Approved borrow material shall be obtained from borrow areas as specified in paragraph Borrow Areas.

### 3.11 SHORING AND SLOPING

#### 3.11.1 General Requirements

Excavations shall be shored and/or sloped as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving. The contractor shall carefully consider all aspects project and the related methods necessary to adequately accomplish the work. Payment for all such work shall be included in the lump sum bid. Shoring and/or sloping performed for basement area excavations must be submitted for approval and must be designed by a registered professional engineer.

#### 3.11.2 Contractor's Geotechnical Engineer

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions during construction of the basement areas. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least



monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration. (Note that these inspections are related to the contractor's implementation of "temporary" features of work in the basement area such as sloping/shoring/dewatering. The contractor's geotechnical engineer should not be confused with the Contracting Officer's Geotechnical Engineer (designer) who is responsible for final determinations and approvals of work affecting the completed project as discussed in this specification).

### 3.12 STOCKPILES

Stockpiles of satisfactory and unsatisfactory materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

### 3.13 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed.

### 3.14 GROUND SURFACE PREPARATION

#### 3.14.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material. Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized and compacted as indicated herein. Within building and pavement areas and to a distance of 5 feet outside these areas, materials shall be moistened or aerated as necessary to achieve an in place moisture content within plus or minus 2 percent of optimum; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. The subgrade areas located a distance of 5 feet or more outside building and paved areas shall be plowed, disked or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted as practical to obtain the specified compaction and stability in the satisfactory fill materials. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a

depth of 12 inches and compacted as specified for the adjacent fill. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of fill materials to assure adequate bond between fill material and the prepared ground surface.

#### 3.14.2 Frozen Material

Material shall not be placed on surfaces that are muddy, frozen, contain frost or which have been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shut downs, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Fill material shall not contain frozen clumps of soil, snow or ice.

#### 3.15 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in the spoil areas indicated in paragraph SPOIL AREAS. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in the spoil areas indicated in paragraph SPOIL AREAS. As previously indicated herein, the contractor shall anticipate that satisfactory materials for fill, embankment and backfill are not available on site and shall be imported. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

#### 3.16 BURIED TAPE AND DETECTION WIRE

##### 3.16.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

##### 3.16.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall

enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

### 3.17 FILLING, BACKFILLING AND COMPACTION

Fill, embankment and backfill shall be placed in layers not exceeding 6 inch loose thickness for compaction by hand operated machine compactors and 8 inch loose thickness for other than hand operated machines unless otherwise specified. Within building and pavement areas and to 5 feet outside these areas (and to a distance behind any retaining or basement/pit walls equal to the height of the walls), fill, embankment and backfill shall be aerated or moistened as necessary to achieve an in-place moisture content within plus or minus 2 percent of optimum moisture. In these areas, each layer of fill, embankment and backfill shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified. Outside the above specified areas, fill, embankment and backfill shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils at a moisture content which facilitates such compaction. Materials shall be placed in a manner to prevent wedging action or eccentric loading upon or against structures. Behind retaining walls and pit and basement walls, (to a distance from the wall equal to the height of the wall), compaction shall be performed with hand operated equipment and such equipment shall also be maintained a minimum distance of 6 inches from the back of the wall. Ground surface on which fill and backfill is to be placed shall be prepared as specified in paragraph GROUND SURFACE PREPARATION. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs SUBGRADE PREPARATION FOR PAVEMENTS AND SLABS, and Section 33 40 01 STORM DRAINAGE. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

#### 3.17.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

##### 3.17.1.1 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Bedding and initial backfill shall meet the requirements previously discussed herein. Where satisfactory soil backfill materials are used, the backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. As previously discussed, cementitious flowable fill must be used for bedding and initial backfill for utility lines which carry fluids.

##### 3.17.1.2 Final Backfill

Final backfill shall consist of satisfactory materials. Final backfill shall be placed and compacted in accordance with paragraph Filling, Backfilling and Compaction.

### 3.17.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for a minimum of 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

### 3.18 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

#### 3.18.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation.

#### 3.18.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 4 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 6 inches of cover is required.

#### 3.18.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 1/4 inch in any dimension.

#### 3.18.4 Electrical Distribution System

Provide a minimum cover of 24 inch from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

### 3.19 SUBGRADE PREPARATION BENEATH PAVEMENTS AND SLABS

#### 3.19.1 Proof Rolling and Subgrade Stabilization

All pavement subgrade areas and building slab areas shall be proof-rolled in the presence of the Contracting Officer prior to placement of the aggregate base or capillary water barrier. Refer to specification 32 11 23 AGGREGATE BASE COURSE (DGA) for detailed proof rolling and subgrade stabilization requirements.

#### 3.19.2 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials or as specified in

paragraph subgrade stabilization, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1/2 inch when tested with a 10-foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

### 3.20 EARTHEN SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

### 3.21 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION BENEATH PAVEMENTS AND SLABS. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

#### 3.21.1 Subgrade and Embankments

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

#### 3.21.2 Capillary Water Barrier

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

#### 3.21.3 Grading Around Structures

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work

has been accepted.

### 3.22 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. The surface shall be free of materials that would hinder planting or maintenance operations. Topsoil then shall be spread evenly to a thickness of 4 inches and graded to the elevations and slopes shown and left free of surface irregularities. Topsoil shall not be spread when frozen or excessively wet or dry. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from borrow areas as specified in paragraph Borrow Areas..

### 3.23 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

### 3.24 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Approval of testing facilities shall be based on requirements indicated in SECTION 01 45 10 CONTRACTOR QUALITY CONTROL. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Moisture-density relations shall be determined in accordance with ASTM D 1557, Procedure C or AASHTO T 180, Method D depending on material type. Field in-place density shall be determined in accordance with ASTM D1556 /D1556M, ASTM D2167 or ASTM D2922. When ASTM D2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D1556/D1556M. ASTM D2922 results in a wet unit weight of soil and when using this method ASTM D3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D2937, Drive Cylinder Method shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Sieve analyses shall be performed in accordance with the latest ASTM C117, ASTM C127, ASTM C128, ASTM C136/C136M and ASTM D422; sieves shall conform to the latest ASTM E11; and liquid limit and plasticity index determinations shall be performed in accordance with ASTM D4318. Copies of these test results shall be furnished to the Contracting Officer. Inspections and test results shall be certified by a registered professional geotechnical engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative

of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### 3.24.1 Subgrade, Fill and Backfill Material Gradation

One sieve analysis (and one liquid limit and plasticity index determination for cohesive soils) per 5000 square yards or fraction thereof of subgrade and per 2000 cubic yards or fraction thereof of fill and backfill. Additional gradation, liquid limit, plasticity index determinations, and moisture-density curves shall be required if there are any changes in gradation or particle shape or when any change occurs in the material which may effect the optimum moisture content or maximum laboratory density.

#### 3.24.2 In-Place Densities

- a. One test per 1000 square yards, or fraction thereof, of subgrade and each lift of fill or backfill beneath paved and building areas. One test per 2500 square yards, or fraction thereof, of subgrade and each lift of fill or backfill in other areas. When compaction is performed by hand operated machines the minimum number of tests specified above shall be tripled.
- b. For trenches, one test per 100 linear feet, or fraction thereof, of subgrade and each lift of embankment or backfill in building and paved areas. One test per 250 linear feet, or fraction thereof, of subgrade and each lift of embankment or backfill in other areas.
- c. Location of tests shall be at the direction of the Government.

#### 3.24.3 Check Tests on In-Place Densities

If ASTM D2922 is used, every fifth in-place density test shall be checked by ASTM D1556/D1556M.

#### 3.24.4 Moisture Contents

A minimum of one test per each density test. In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

#### 3.24.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test shall be done for each type of subgrade material (embankment, fill and cut areas); and per 2000 cubic yards of fill and backfill or fraction thereof, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

#### 3.24.6 Flowable Fill Testing

Strength results shall be from testing of molded cubes 2 inch square in accordance with ASTM C109/C109M. Test data shall include both 7 day and

28 day strength information. Tests for strength shall also be taken during construction for every 50 cubic yards of material placed.

#### 3.24.7 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified herein shall be made during construction of the subgrades.

#### 3.24.8 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

#### 3.25 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be disposed of in spoil areas as specified in paragraph SPOIL AREAS.

-- End of Section --



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WELDING PRESSURE PIPING

04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Std 1104 (2013; Errata 1-3 2014; Addendum 1 2014; Errata 4 2015; Addendum 2 2016) Welding of Pipeline and Related Facilities

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT SNT-TC-1A (2020) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.3 (2020) Process Piping

ASME B31.4 (2019) Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquid

ASME B31.9 (2020) Building Services Piping

ASME BPVC SEC II-C (2017) BPVC Section II-Materials Part C-Specifications for Welding Rods Electrodes and Filler Metals

ASME BPVC SEC IX (2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

ASME BPVC SEC V (2017) BPVC Section V-Nondestructive Examination

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0M/A3.0 (2020) Standard Welding Terms and Definitions

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

## Repair Steam Sterilization Plant (SSP)

AWS Z49.1 (2021) Safety in Welding and Cutting and Allied Processes

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

### 1.2 RELATED REQUIREMENTS

- A. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section with the additions and modifications specified herein.
- B. Section 22 10 05 BUILDING SERVICES AND PROCESS PIPING SYSTEMS applies to this section with the additions and modifications specified herein.
- C. Section 22 10 06 BUILDING SERVICES AND PROCESS PIPING SCHEDULES applies to this section with the additions and modifications specified herein.

### 1.3 DEFINITIONS

AWS A3.0M/A3.0 and applicable ANSI piping documents.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Welding pressure piping

SD-07 Certificates

Welding procedures qualification

Nondestructive examination (NDE) procedures

NDE personnel certification procedures

Inspector certification

Submit inspector certification and NDE personnel certification for record.

SD-11 Closeout Submittals

Weld identifications

## 1.5 QUALITY ASSURANCE

### 1.5.1 Welding Pressure Piping

Show location, length, and type of welds, and indicate postweld heat treatment and nondestructive testing as required.

### 1.5.2 Procedures

Develop and qualify procedures for welding metals included in the work. Do not start welding until welding procedures, welders, and welding operators have been qualified. Perform qualification testing by an approved testing laboratory, or by the Contractor if approved by the Contracting Officer in accordance with the qualified procedures. Notify the Contracting Officer at least 24 hours in advance of the time and place of the tests. When practicable, perform the qualification tests at or near the work site. Maintain current records of the test results obtained in welding procedure, welding operator/welder performance qualifications, and nondestructive examination (NDE) procedures. These records shall be readily available at the site for examination by the Contracting Officer. Qualify the procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses. ANSI Piping requirements for branch connections may be used in lieu of detailed designs. Unless otherwise specified, the choice of welding process shall be the responsibility of the Contractor. All welders shall be re-qualified prior to commencing with any work and no more than 3 months from the time of welding activities. All welding qualifications, certifications and procedures shall apply to both shop and field welding activities.

#### 1.5.2.1 Performance

The Contractor shall be responsible for the quality of joint preparation, welding, and examination. Clearly identify and record materials used in the welding operations. The examination and testing defined in this specification are minimum requirements. Provide additional examination and testing as necessary to achieve the quality required.

### 1.5.3 Welding Procedures Qualification

Qualification of the welding procedures for each group of materials to be welded is required as indicated in ASME BPVC SEC IX. Record in detail and qualify the "Welding Procedure Specifications" for every welding procedure proposed. Qualification for each welding procedure shall conform to the requirements of ANSI Standards and to this specification. The welding procedures shall specify end preparation for welds, including cleaning, alignments, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by ANSI Piping documents, unless otherwise indicated or specified. All qualification welds shall be made without the use of backing rings or consumable inserts. Welding procedure qualifications shall be identified individually and referenced on the shop drawings or suitably keyed to the contract drawings.

### 1.5.4 Welder and Welding Operator Performance Qualification

Qualify each welder and welding operator assigned to work covered by this specification by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires from the same

specification, classification, or group number that will be encountered on his assignment. Welders or welding operators who make acceptable procedure qualification tests will be considered performance-qualified for the welding procedure used. Determine performance qualification in accordance with ASME BPVC SEC IX and as specified.

#### 1.5.5 Renewal of Qualification

Requalification of a welder or welding operator shall be required under one or any combination of the following conditions:

All welders shall be re-qualified prior to commencing with any work and no more than 3 months from the time of welding activities. All welding qualifications, certifications and procedures shall apply to both shop and field welding activities

#### 1.5.6 Qualification of Inspection and (NDE) Personnel

Qualification of Inspection and Nondestructive Examination (NDE) Personnel: Qualify inspection and nondestructive examination personnel in accordance with the following requirements:

##### 1.5.6.1 Inspector Certification

Qualify welding inspectors in accordance with AWS QC1.

##### 1.5.6.2 NDE Personnel Certification Procedures

Certify NDE personnel and establish a written procedure for the control and administration of NDE personnel training, examination, and certification. Base procedures on appropriate specific and general guidelines of training and experience recommended by ASNT SNT-TC-1A, Supplement C-Ultrasonic .

##### 1.5.6.3 Welding Procedures and Qualifications

- a. Specifications and Test Results: Submit copies of the welding procedure specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.
- b. Certification: Before assigning welders or welding operators to the work, submit their names, together with certification that each individual is performance qualified as specified. Do not start welding work prior to procedure qualification. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

#### 1.5.7 Symbols

Conform to AWS A2.4.

##### 1.5.7.1 Weld Identifications

Submit a list of the welders' names and symbol for each welder. To

## Repair Steam Sterilization Plant (SSP)

identify welds, submit written records indicating the location of welds made by each welder or welding operator.

### 1.5.8 Safety

Conform to AWS Z49.1, 29 CFR 1910-SUBPART Q, "Welding, Cutting, and Brazing," 29 CFR 1926-SUBPART J, "Welding and Cutting."

### 1.6 ENVIRONMENTAL

Do not perform welding when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contracting Officer will determine when weather or working conditions are unsuitable for welding.

### 1.7 DELIVERY AND STORAGE

Deliver filler metals, electrodes, fluxes and other welding materials to the site in manufacturers' original packages and store in a dry space until used. Label and design packages properly to give maximum protection from moisture and to assure safe handling.

## PART 2 PRODUCTS

### 2.1 WELDING MATERIALS

Comply with ASME BPVC SEC II-C. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

## PART 3 EXECUTION

### 3.1 WELDING

Do not deviate from applicable codes, approved procedures and approved shop drawings without prior written approval from the Contracting Officer. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this specification unless otherwise specified. Assign each welder or welding operator an identifying number, letter, or symbol that shall be used to identify his welds. Each welder or welding operator shall apply his mark adjacent to his weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal. For seam welds, place identification marks adjacent to the welds at 3 foot intervals. Confine identification by die stamps or electric etchers to the weld reinforcing crown, preferably in the finished crater.

### 3.2 WELDING OPERATORS

Perform welding in accordance with qualified procedures using qualified welders and welding operators.

### 3.3 SUPPORTS

Welding of hangers, supports, and plates to structural members shall conform to AWS D1.1/D1.1M.

### 3.4 EXAMINATIONS AND TESTS

Visual and nondestructive examinations will be performed by an AWS Certified, independent 3rd party hired as a 1st tier sub-contractor to the General Contractor with active certification for all applicable visual and testing methods, to detect surface and internal discontinuities in completed welds. Visually examine welds and perform Ultrasonic examination in accordance with other sections where detailed requirements are specified. Random NDE testing applies to ASME B31.3 and ASME B31.4 piping unless specified otherwise. When examination and testing indicates defects in a weld joint, a qualified welder shall repair the weld in accordance with the paragraph entitled "Corrections and Repairs" of this section. Random NDE testing shall be performed on 50% of welds that were performed. If any weld is not found to have passed, then 100% of welds will be examined.

#### 3.4.1 Random NDE Testing

When ultrasonic examination is required, test a minimum of 50 percent of the total length or number of piping welds. Randomly select the welds examined, but include an examination of welds made by each welding operator or welder. If random testing reveals that a weld fails to meet minimum quality requirements, examine 100 percent of the welds in that same group. If the additional welds examined meet the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds examined also fail to meet the quality requirements, that entire group of welds shall be rejected. Remove and reweld rejected welds or examine rejected welds 100 percent and remove and reweld defects.

#### 3.4.2 Visual Examination

Visually examine welds as follows:

- a. Before welding -- for compliance with requirements for joint preparation, alignment and fit-up, and cleanliness.
- b. During welding -- for conformance to the qualified welding procedure.
- c. After welding -- for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.

#### 3.4.3 Nondestructive Examination

NDE shall be in accordance with written procedures. Procedures for ultrasonic tests and methods shall conform to ASME BPVC SEC V. The approved procedure shall be demonstrated to the satisfaction of the Contracting Officer's QA personnel. In addition to the information required in ASME BPVC SEC V, the written procedures shall include:

- a. Timing of the nondestructive examination in relation to the welding operations.
- b. Safety precautions.

### 3.5 ACCEPTANCE STANDARDS

#### 3.5.1 Visual

The following indications are unacceptable:

- a. Cracks--external surface.
- b. Undercut on surface which is greater than  $1/32$  inch deep or 25 percent for ASME B31.3 and 12.5 percent for ASME B31.4 and ASME B31.9 of the wall thickness, whichever is less, provided that the remaining wall thickness is not less than the minimum design thickness. For ASME B31.4 and in accordance with API Std 1104, undercuts over  $1/64$  inch through  $1/32$  inch or over 6 to 12.5 percent of the pipe wall thickness, whichever is smaller, shall not exceed 2 inches in a continuous weld length of 12 inches or  $1/6$  the length of the weld, whichever is smaller; and undercuts  $1/64$  inch or 6 percent of the wall thickness, whichever is smaller, are acceptable regardless of length.

#### 3.5.2 Ultrasonic Examination

Permitted for ASME B31.3 and ASME B31.4 piping only. Linear type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths which exceed the following:

- a.  $1/4$  inch for  $t$  up to  $3/4$  inch
- b.  $1/3 t$  for  $t$  from  $3/4$  inch to  $2 1/4$  inches
- c.  $3/4$  inch for  $t$  over  $2 1/4$  inches

("t" is the thickness of the weld being examined. If the weld joins two members having different thickness at the weld, "t" is the thinner of these two thicknesses. Discontinuities are interpreted to be cracks, lack of fusion, and incomplete penetration are unacceptable regardless of length.)

### 3.6 CORRECTIONS AND REPAIRS

Remove defects and replace welds as specified in ANSI Piping Standards, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, reexamine the area by the same test methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. For repairs to base material, the minimum examination shall be the same as required for butt welds. Indication of a defect shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no unacceptable indications are present. The use of foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

-- End of Section --