

Global ASNT Storage Facility

*117th Air Refueling Wing
Birmingham IAP, Air National Guard Base
Birmingham, AL*

Project Number BRKR 202911

Submitted to
Alabama Air National Guard
February 2023

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SECTION 00 0102 - PROJECT INFORMATION AND SUMMARY

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: Global ASNT Storage Facility, located at 117th Air Refueling Wing, Air National Guard (ANG) Base at Birmingham IAP, Birmingham, AL.
- B. Government Project Number: BRKR 202911
- C. Architect's Project Number: 21047.00
- D. The Owner, hereinafter referred to as the Government
- E. Government's Project Manager: Representatives:
 - 1. Contracting Officer: Mr. Craig Kast
 - 2. Contracting Specialist: Maj. Jeff Farmer
 - 3. Contracting Officer Representative: LTC Scott Vandenberghe, Base Civil Engineer
 - 4. Alternate Contracting Officer Representative: Lt Matthew Chandler

1.02 CONTRACT DURATION

- A. 210 calendar days from notice to proceed to Beneficial Occupancy. Contract Duration includes time for completion of punch list activities identified at the project final inspection.
- B. The Government intends to occupy existing portions of Building 30 that are not included within the primary work areas during the duration of the Construction. Contractor to coordinate work with the Owner's continued occupation.
- C. The Government intends to occupy the new addition upon Beneficial Occupancy.

1.03 PROJECT DESCRIPTION

- A. The Project Scope includes, but is not limited to, the following:
 - 1. Demolition:
 - a. Demolition of existing exterior wall and roof finishes in the area of the proposed addition as indicated on the drawings/required for successful completion of the work.

- b. Demolition of existing exterior site elements as required for the new facility construction.
 - c. Minor interior finish demolition within the existing footprint of Building 30 as required to connect to, and extend existing building systems to new addition.
- 2. Construction of a 500 square foot addition to Building 30 consisting of, but not limited to the following:
 - a. New reinforced concrete foundations and concrete slab-on-grade.
 - b. New load bearing concrete masonry walls with a combination of metal wall panels and clay masonry facade elements to match the existing facility.
 - c. Steel stud roof framing supporting a new metal deck, new rigid insulation, and new thermoplastic roof membrane.
 - d. New dedicated mini-split HVAC systems connected to existing in electrical distribution systems in Building 30.
 - e. New LED lighting systems connected to existing electrical distribution systems in Building 30.
 - f. New fire alarm devices connected to existing fire alarm systems in Building 30.
 - g. Extension of existing wet-pipe sprinkler to serve addition.
 - h. Site grading as required for building addition.
 - i. New concrete paving systems for facility egress and access.
- B. Sustainability Design and Energy Conservation:
 - 1. The project has not been registered with USGBC and is not intended to be registered. The project is not intended to achieve any level of LEED certification or any other sustainability certifications; however, in accordance with ANGETL 15-01-01, the project is intended to be "LEED Meritable" and incorporate sustainable design principles and criteria to the maximum extent possible.
 - 2. In keeping with ANGETL 15-01-01 Contractor shall give preference to sustainable products and materials with higher levels of sustainability including but not limited to materials extracted and manufactured within 500 miles of the project site, materials manufactured using higher levels of recycled content, materials meeting VOC limitations, etc.

3. Where applicable, minimum thresholds for sustainability criteria are established within the technical specifications. Where not specifically indicated, the Contractor shall give preference to and provide materials that contribute the most to the project's sustainability goal.
4. Contractor shall provide "LEED Submittals" for all products, materials, and systems indicating a product or material's sustainable attributes for review and approval by the Government; however, input of LEED documentation into the USGBC's LEED online system will be not required. Similarly, LEED credit templates documenting the projects LEED performance will not be required.

C. Contractor's Qualified Fire Protection Engineer (QFPE) Services

1. The Contractor shall employ a Qualified Fire Protection Engineer (QFPE) meeting the requirements of UFC 3-600-01.
2. The QFPE shall review, sign, and certify all fire protection and life safety systems including; but, not limited to fire alarm, mass notification, and sprinkler systems included within the proposed project.
3. All shop drawing / calculations / material submittals for applicable life safety systems must be reviewed and stamped by the Contractor' QFPE in accordance with section 9-6.3 of UFC 3-600-01.
4. Waterflow testing shall be performed under the direction of the Contractor's QFPE in accordance with section 9-6.4 of UFC 3-600-01. Waterflow testing shall be performed by the Contractor in order to develop required hydraulic calculations. Use of waterflow testing performed by the Architect during design cannot be utilized by the Contractor for preparation of project submittals.
5. During Construction the Contractor's QFPE must visit the site in intervals/quantities required to certify that the system has been installed in accordance with the project requirements. At a minimum, the QFPE shall attend/witness the above ceiling inspection and attend/witness final acceptance testing for all fire protection and life safety systems. Additional site inspections are at the discretion of the Contractor's QFPE. The Contractor's QFPE shall certify, in writing, that the system has been installed in accordance with project requirements. The Contractor's QFPR certification shall be in writing, on company letterhead, and include the QFPE's registration stamp.

1.04 PERMITS, FEES AND NOTICES

- A. Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work which are customarily secured after award of the Construction Contract and which are in effect on the solicitation response date:
 - 1. City of Birmingham Building Permit is not required.
- B. The Contractor shall comply with and give notices required by all laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

1.05 USE OF SITE AND MISC. REQUIREMENTS

- A. The space available to the contractor for the performance of the work, either exclusively or in conjunction with others performing other construction as part of the project, is as per the Government's approval.
 - 1. Other areas are off limits to all construction personnel.
 - 2. Use of existing areas within Building 30 for construction storage or staging is not permitted. Contractor to provide secure storage units adjacent to the facility for construction staging and storage. Approved locations for Contractor storage units will be as directed by the Contracting Officer Representative on site at the time of project mobilization.
- B. Access to site will be limited; obtain Government's approval of proposed routes of access.
- C. Keep existing sidewalks, roads, parking lots and drives on site clear and available at all times. Promptly remove mud, dirt, debris, etc. from sidewalks, streets, and public right-of-way during construction as it occurs.
- D. Storage areas on site are very minimal and will be limited to materials that are to be immediately used in the progress of the work. If additional storage is required, then Contractor shall secure and be responsible to pay for such off site storage in a fully bonded and insured facility acceptable to the Government, with all items clearly identified as being assigned to this project.
- E. Provide secure temporary barricades, fencing, etc. as required to separate the public from construction operations. Compliant safety and/or warning signage is to be provided as well in conjunction with fencing and barricades.

1. Site safety and security is the General Contractor's responsibility. Fencing shall be provided as deemed necessary to protect the site from theft and damage and to prevent access to the site by the public. A fence along the project limits is anticipated at a minimum. However, exact location/extents of fencing is at the discretion of the Contractor.
- F. Construction operations are not to affect any of the ongoing operations throughout the site and/or adjacent sites. Construction equipment is not to be attached to, or swing over existing buildings to remain, public areas, occupied buildings or parking lots, right-of-ways, etc.
- G. Comply with the Government's security requirements. Refer to Specification Section 01 3553.
- H. The contractor shall provide all testing, inspections, and similar services; these services also include those specified to be performed by an independent agency.

1.06 UTILITY OUTAGES AND SHUTDOWN

- A. All electrical and communication shut downs shall be performed on a non-working day for the Government (Saturday, Sunday, Monday, or Holidays) unless specifically approved by the Contracting Officer Representative.
- B. Limit shutdown of utility services to 8 hours at a time, arranged at least 72 hours in advance with the Government.
- C. Prevent accidental disruption of utility services to other facilities.

1.07 PHASING OF WORK

- A. The work of this project shall be completed in one phase. However, the Contractor shall coordinate the work as required to ensure Building 30, and all existing roadways and facilities adjacent to the project site remain open and accessible for use by the Government.

1.08 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Contracting Officer Representative.
 1. Submit proposed construction schedule to the Government for review as outlined in the Government's solicitation requirements.
 2. Coordinate project schedule with continued occupancy of Building 30 by Government personnel.

1.09 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Government: Seay Seay & Litchfield P.C..

1. Address: 1115 South Court Street.
2. City, State, Zip: Montgomery AL 36104.
3. Phone/Fax: 334-263-5162 / 334-263-5170.
4. Project Manager: David Donovan, AIA, LEED AP
5. Principals-in-Charge: Wes R. Osmer, AIA, LEED AP

B. Architect's Consultants:

1. Civil Engineering:
 - a. Professional Engineering Consultants
 - b. Address: 822 South McDonough St..
 - c. City, State, Zip: Montgomery, AL, 36104.
 - d. Phone/Fax: 334-262-7307 / 334-262-7309.
 - e. Contact: Steve Green
2. Plumbing, Mechanical & Fire Suppression Engineering:
 - a. Peterson Engineering
 - b. Address: 75 South F Street
 - c. City, State, Zip: Pensacola, FL 32502
 - d. Phone: (850) 434-0513
 - e. Contact: Steve Johnson, PE
3. Electrical Engineering:
 - a. McCarter Engineering
 - b. Address: 878 Avalon Ln
 - c. City, State, Zip: Anniston, AL 36207
 - d. Phone: (256) 240-7335

e. Contact: Stan McCarter, P.E.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 0450 - CUTTING AND PATCHING

1. GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including requirements of the Government's Solicitation and other Division-1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Divisions 21, 22, 23, 26 & 27 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures and/or phasing for cutting and patching is required before proceeding, submit a proposal describing procedures 10 business days in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
- B. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
- C. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
- D. List products to be used and firms or entities that will perform Work.
- E. Indicate dates when cutting and patching is to be performed.
- F. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

- G. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
- H. Approval by the Contracting Officer to proceed with cutting and patching does not waive the Contracting Officer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - 1. Foundation construction.
 - 2. Bearing and retaining walls.
 - 3. Structural concrete.
 - 4. Structural steel.
 - 5. Lintels.
 - 6. Timber and primary wood framing.
 - 7. Structural decking.
 - 8. Stair systems.
 - 9. Miscellaneous structural metals.
 - 10. Exterior curtain wall construction.
 - 11. Equipment supports.
 - 12. Piping, ductwork, vessels and equipment.
 - 13. Structural systems of special construction in Division-13.
- C. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

- a. Primary operational systems and equipment.
- b. Membranes and flashings.
- c. Fire protection systems.
- d. Communication systems.
- e. Electrical wiring systems.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 - 1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
 - 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.04 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

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SECTION 01 0500 - FIELD ENGINEERING

1. GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and other Division-1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Land Survey Work.

1.03 SUBMITTALS

- A. Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents.
- B. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

1.04 QUALITY ASSURANCE

- A. Surveyor: Engage a Registered Land Surveyor registered in the State of Alabama, to perform land surveying services required.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Government will identify existing control points and property line corner stakes.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.

2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of one permanent benchmark on the site, referenced to data established by survey control points.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.
 2. The Government requires a dig permit to be submitted for and approved prior to drilling or digging that might impact underground utilities. Coordinate with Contracting Officer Representative in advance of activities requiring an approved dig permit. Submit permit application to Base Civil Engineering a minimum of one week prior to scheduled start of activities requiring a dig permit.

3.02 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
 1. Record deviations from required lines and levels, and advise the Contracting Officer when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- E. Existing Utilities: Verify locations of all utilities prior to commencing. Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with Base Civil Engineering via the Contracting Officer's Representative.

END OF SECTION

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SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Price and Contract Time.
- C. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: Government's Approved Form.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to the Government for approval.
- C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.
 - 1. Provide separate line items for material and labor for each item of work.
 - 2. Provide separate line items for each direct general contractor's cost for general conditions including:
 - a. Bonds
 - b. Insurance
 - c. Superintendent
 - 3. Break larger items of work down into line items not exceeding \$50,000 in value unless specifically approved by the Government.
- D. Revise schedule to list approved Change Orders, with each Application For Payment.
 - 1. Change Orders should be listed as separate line items included at the end of the schedule of values.
 - 2. When a Change Order includes multiple items of work, each item of work shall be listed as a separate line item with the approximate percentage complete for each scope of work listed.
- E. Submit schedule of values within the timeframe outlined in the General Conditions of the Contract for Construction.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Comply with all requirements of the General Conditions of the Contract for Construction. Additional requirements/explanations are listed below.
- B. Use Form Owner's Approved Form.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to the Government for approval.
- D. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 - 1. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- E. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Current construction photographs specified in Section 01 3000.

1.05 STORED MATERIALS:

- A. Off-site stored materials must be authorized for consideration in the awarded contract and be approved by the Contracting Officer if the Contractor anticipates requesting payment for off-site stored materials prior to the materials being delivered to the project site and and/or placed into operation/construction.
- B. The following will be required prior to approval of payment for off-site stored materials:
 - 1. Bill of lading for materials.
 - 2. Documentation that the materials have been titled to the Contractor and will be used exclusively in the performance of the Contract.
 - 3. Evidence of insurance for the facility storing the materials reflecting 100% total replacement value coverage.
 - 4. Photographs of the materials being stored.

- C. The Contracting Officer must verify and approve of off-site stored materials prior to approval of payment. Approval of off-site storage (item A above) will not guarantee approval of payment for off-site stored materials. Payment of off-site stored materials will be at the discretion of the Contracting Officer pending verification of the materials being stored and review of required documentation (item B above) offered by the Contractor with the application for payment.

1.06 MODIFICATION PROCEDURES

- A. Comply with all requirements of the Government's solicitation including applicable referenced sections of the Federal Acquisitions Regulations.
- B. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- C. Do not proceed with work associated with a modification prior to final execution of modification by Contracting Officer.
- D. Following execution of modification by the Contracting Officer, promptly:
 - 1. Revised application of payment forms to record each authorized modification as a separate line item and adjust the Contract Price.
 - 2.
 - 3.

1.07 APPLICATION FOR FINAL PAYMENT

- A. Comply with all requirements of the General Conditions of the Contractor for Construction.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 7000.
 - 2. All stipulated requirements stated in the General Conditions of the Contract for Construction. .

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
 - 1. Construction Superintendent
 - 2. Project Manager
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Coordination meetings with adjacent construction projects.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Coordination drawings.

1.02 RELATED REQUIREMENTS

- A. Section 00 0102 - Project Information and Summary
- B. Section 01 7000 - Execution and Closeout Requirements
- C. Section 01 7800 - Closeout Submittals

1.03 PROJECT COORDINATION

- A. Contractor's Project Manager: The General Contractor shall provide a project manager with a minimum of five years experience on projects of similar size and type. Prior to construction the project manager shall submit a resume of the project manager to the Government for approval..
- B. Make the following types of submittals to the Contracting Officer Representative through the Project Manager:
 - 1. Requests for interpretation.
 - 2. Requests for substitution

3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Application for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Closeout submittals.

1.04 CONSTRUCTION SUPERINTENDENT

- A. The General Contractor shall designate a project superintendent to be on site and in charge of the work for the duration of the project.
- B. The Superintendent shall have experience in supervising and executing a minimum of 5 projects of similar scope, size, and complexity.
- C. Submit proposed superintendent's resume to the Government for approval prior to commencing on-site activities.
- D. Superintendent shall be equipped with a cellular device capable of:
 1. Placing and receiving local and long-distance phone calls
 2. Viewing and responding to electronic mail communication.
 3. Connecting personal computer to the internet via a mobile hotspot application.
- E. The Superintendent shall also be equipped with a personal computer that can access the internet for the purposes of project correspondence and accessing the project "Newforma" project management software/platform.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 2. Contractor and Government are required to use this service.
 3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Government's consultants will be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The Cost of the service will be paid by the Architect. The Contractor will be granted access to the service by the architect. The service is accessed through a web-based interface.
- C. Submittal Service: The selected service is:
1. Newforma Info Exchange.

- D. Training: Training is the responsibility of the user of the service. A reference guide inclusive of video tutorials can be accessed and viewed at http://help.newforma.com/newforma_info_Exchange_twelfth_edition/desktop/Overviews/Welcome_to_Newforma_Info_Exchange.htm

3.02 PRECONSTRUCTION MEETING

- A. Contractor will schedule a meeting after notice to proceed.
- B. Attendance Required:
1. Contracting Officer
 2. Contracting Officer Representative
 3. Architect
 4. Contractor:
 - a. Contractor shall be represented, in person, at the preconstruction meeting by the proposed project superintendent and the proposed project manager.
Project manager shall be an employee of the General Contractor. If a third-party project management approach is utilized by the General Contractor, both the third-party project manager and a representative of the General Contractor who is authorized to make decisions regarding project scope, cost, and time shall also be in attendance, in person, at the preconstruction meeting.
 - b. All major sub contractors and suppliers
- C. Agenda:
1. Submission of list of Subcontractors, , list of products, schedule of values, and progress schedule.
 2. Designation of personnel representing the parties to the Contract and Architect.
 3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 4. Scheduling.
 5. Use of "Newforma" online web application for RFI, submittals, etc... Refer to section 01 3001 for additional information.
- D. Architect will record minutes and distribute copies promptly after meeting to participants, with copies to Architect, Contracting Officer Representative(s), Contracting Officer, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Contractor shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- B. Attendance Required: Job superintendent, Contractor's Project Manager, Contracting Officer, Contracting Officer Representative(s), Architect, and major Subcontractors/Suppliers when necessary/requested by the Government/Contractor.
 - 1. A minimum of bi-weekly meetings should be anticipated. More frequent meetings will be scheduled as dictated by the progress and quality of work observed ongoing at the project site. Contractor's project superintendent shall attend all progress meetings in person.
 - 2. Additionally, if a third-party project management approach is utilized by the General Contractor, both the third-party project manager and a representative of the General Contractor who is authorized to make decisions regarding project scope, cost, and time shall also be in attendance, in person, at a minimum of one progress meeting each month.
- C. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of RFIs log and status of responses.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Maintenance of quality and work standards.
 - 11. Effect of proposed changes on progress schedule and coordination.
 - 12. Review of modifications to project record documents documenting changes made on site since previous progress meeting.
 - 13. Other business relating to Work.

- D. Architect will record minutes and distribute copies promptly after meeting to participants, with copies to Architect, Contracting Officer Representative(s), Contracting Officer, and Contractor. Contractor will be responsible for distributing minutes to suppliers/SubContractor and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216

- A. Submit proposed project schedule as outlined in the Contract Documents.
- B. General Requirements:
 - 1. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Beneficial Occupancy to date of Final Completion.
 - 2. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - a. Activity Duration: Define activities so no activity is longer than twenty days, unless specifically allowed by the Government.
 - b. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - c. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 - d. Startup and Testing Time: Include not less than seven days for startup and testing.
 - e. Beneficial Occupancy: Indicate completion in advance of date established for Beneficial Occupancy, and allow time for the Government's administrative procedures necessary for certification of Beneficial Occupancy.
 - 3. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - a. Phasing: Arrange list of activities on schedule by phase.
 - b. Work by the Government: Include a separate activity for each portion of the Work performed by the Government.

- c. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - d. Government-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - e. Work Restrictions: Show the effect of the following items on the schedule:
 - 1) Coordination with existing construction.
 - 2) Limitations of continued occupancies.
 - 3) Uninterruptible services.
 - 4) Partial occupancy before Beneficial Occupancy.
 - 5) Use of premises restrictions.
 - 6) Provisions for future construction.
 - 7) Seasonal variations.
 - 8) Environmental control.
 - 4. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, review inspections by review agencies, Beneficial Occupancy, and Final Completion.
 - 5. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
 - a. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.
 - 6. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.
- C. Gantt-Chart Schedule:
- 1. Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within thirty days of date established from the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

2. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - a. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in ten percent increments within time bar.
- D. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- E. Distribution: Distribute copies of approved schedule to the Government, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.05 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. List of separate contractors at Project site.

5. Approximate count of personnel at Project site.
6. Major equipment at Project site.
7. Material deliveries.
8. Safety, environmental, or industrial relations incidents.
9. Meetings and significant decisions.
10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
11. Testing and/or inspections performed.
12. Signature of Contractor's authorized representative.

3.06 PRE-CONSTRUCTION PHOTOGRAPHS

- A. Before starting construction, take one hundred color photographs and digital video recording of Project site and affected right-of-ways and surrounding properties and interior existing photos of affected areas from different vantage points, as directed by the Government. Show existing conditions adjacent to property.

3.07 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of construction throughout progress of Work produced by an experienced photographer, who can also be an employee of the contractor, acceptable to the Government.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
 1. Completion of site clearing.
 2. Excavations in progress.
 3. Foundations in progress and upon completion.
 4. Structural framing in progress and upon completion.

5. Enclosure of building, upon completion.
 6. Final completion, minimum of ten (10) photos.
- E. Views:
1. Provide non-aerial photographs from four cardinal views at each specified time, until Date of Beneficial Occupancy.
 2. Consult with the Government for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- F. Digital Photographs: 24 bit color, minimum resolution of 1600 by 1200 ("2 megapixel"), in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via Newforma.
 2. File Naming: Include project identification, date and time of view, and view identification.

3.08 SUBMITTALS

- A. See section 01 3001 - Submittals.

END OF SECTION

SECTION 01 3001 - SUBMITTALS

PART I - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Preparing and processing of submittals for review and action.
 - 2. Preparing and processing of informational submittals.
- B. Submit the following for the Contracting Officer's review and action:
 - 1. Shop drawings.
 - 2. Structural design information required by the contract documents.
 - 3. Product data.
 - 4. Samples.
 - 5. Submittals indicated as "for approval."
 - 6. Submittals for which procedures are not defined elsewhere.
 - 7. Submittal register.
- C. Submit the following as informational submittals:
 - 1. Certificates.
 - 2. Coordination drawings.
 - 3. Reports.
 - 4. Qualification statements for manufacturers/installers.
 - 5. Submittals indicated as "for information only."
- D. Specific submittals required are described in individual sections.
- E. Related Sections: The following are specified elsewhere in Division 1:
 - 1. Product submittals:
 - a. Product option submittals.
 - b. Requests for substitution.

- c. Operating and maintenance data.
 - d. Warranties.
 - e. Maintenance materials and tools.
- 2. Contract closeout submittals:
 - a. Equipment and systems demonstration reports.
 - b. Request for determination of Beneficial Occupancy.
 - c. Certificate of occupancy.
 - d. Project record documents.
 - e. Bonds.

1.02 DEFINITIONS

- A. Shop Drawings: See General Conditions.
 - 1. Shop drawings also include:
 - a. Product data specifically prepared for this project.
 - b. Shop or plant inspection and test reports, when made on specific materials, products, or systems to be used in the work.
- B. Product Data: See General Conditions.
 - 1. Product data submittals also include:
 - a. Performance curves, when issued by the manufacturer for all products of that type.
 - b. Selection data showing standard colors.
 - c. Wiring diagrams, when standard for all products of that type.
- C. Samples: See General Conditions.
- D. Informational Submittals: Submittals identified in the contract documents as to be submitted for information only.

1.03 FORM OF SUBMITTALS

- A. Use AF Form 3000 as the only acceptable form of approval and transmittal.

1. Transmit submittal data (including AF Form 3000) electronically. The Architect will provide and maintain an online website electrical submittal database for access by the Government, Architect, and Contractor.
2. Paper format submittals will not be accepted except where specifically approved by the Government prior to submission.
3. Use of Architect's "Newforma" Website Application:
 - a. General Contractor shall use Architect's website software Newforma with access provided by the Architect to conduct all submittal reviews in electronic format.
 - b. All recordkeeping, date stamping, access controls, shall be accomplished and managed by the contractor with access given to the entire project team.
 - c. The software is capable of the following:
 - 1) Markups & notations- marked electronically,
 - 2) Sending submittals - Instant transfer, no maximum size
 - 3) Logging & tracking,
 - 4) Automatic reminders of outstanding items,
 - 5) Central list of all required submittals for project team to work from,
 - 6) Access for all team members to monitor submittal status & progress,
 - 7) Clear version history with record of changes at each step.
 - d. Contractor shall be responsible for any scanning required to upload PDFs.
 - 1) All submittals must bear the stamp of the General Contractor indicating that the General Contractor's personnel have reviewed the submittal for compliance with project requirements prior to uploading the submittal to "Newforma."
 - e. Orientation to the software is available on Newforma.com or Newformant.com.
4. In addition, all RFIs, proposals, pay requests, action items, and electronic document management will be handled thru the Newforma Info Exchange site.

5. Upon approval of all submittals, the Contractor shall furnish the Government one hard copy of the reviewed submittal complete with all review comments, markups, and a completed AF Form 3000 for project record.
- B. Physical samples: 3 sets of each.
1. 1 set will be returned.
 2. Physical samples shall be sent via mail, overnight delivery, or courier at the Contractor's discretion but be logged into "Newforma" by the Contractor for tracking and reference.
 3. If additional sets are needed by other entities involved in work represented by the samples, submit with original submittal.
 4. Copies in excess of the number requested will not be returned.
- C. Submittals for Operation & Maintenance:
1. Provide all submittal data for operation & maintenance in electronic (.pdf) format.
 2. In addition to the electronic format, provide two copies of original warranty documentation for all specified warranties.
 - a. Warranty documentation to be 3-hole punched and bound together in a 3 ring binder.
 - b. Warranty documentation should be tabbed and organized by specification section.

1.04 COORDINATION OF SUBMITTALS

- A. Coordinate submittals and activities that must be performed in sequence, so that the Contracting Officer and Contracting Officer Representative(s) have enough information to properly review the submittals.
- B. Coordinate submittals of different types for the same product or system so that the Contracting Officer and Contracting Officer Representative(s) have enough information to properly review each submittal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TIMING OF SUBMITTALS

- A. Transmit each submittal at or before the time indicated on the approved schedule of submittals.
 - 1. Prepare and submit for approval a schedule showing the required dates of submittal of all submittals.
 - 2. Organize the schedule by the applicable specification section number.
 - 3. Incorporate the contractor's construction schedule specified elsewhere.
 - 4. Incorporate the quality control activities schedule specified elsewhere.
 - 5. Submit within 15 days after commencement of the work.
 - 6. Revise and resubmit the schedule for approval when requested.
- B. Deliver each submittal requiring approval in time to allow for adequate review and processing time, including resubmittals if necessary; failure of the contractor in this respect will not be considered as grounds for an extension of the contract time.
- C. Deliver each informational submittal prior to start of the work involved, unless the submittal is of a type which cannot be prepared until after completion of the work; submit promptly.
- D. If a submittal must be processed within a certain time in order to maintain the progress of the work, state so clearly on the submittal.
- E. If a submittal must be delayed for coordination with other submittals not yet submitted, the Contracting Officer may either return the submittal with no action or notify the contractor of the other submittals which must be received before the submittal can be reviewed.

3.02 SUBMITTAL PROCEDURES - GENERAL

- A. Contractor Review: Sign each copy of each submittal certifying compliance with the requirements of the contract documents.
- B. Notify the Contracting Officer, in writing and at time of submittal, of all points upon which the submittal does not conform to the requirements of the contract documents, if any.

- C. Do not commence work which requires review of any submittals until receipt of returned submittals with an acceptable action.
- D. Do not allow submittals without an acceptable action marking to be used for the project.
- E. Do not submit substitute items that have not been approved by means of the procedure specified elsewhere.
- F. Do not include requests for substitution (either direct or indirect) on submittals; comply with procedures for substitutions specified elsewhere.
- G. Preparation of Submittals:
 - 1. Label each copy of each submittal, with the following information:
 - a. Project name.
 - b. Date of submittal.
 - c. Contractor's name and address.
 - d. Architect's name and address.
 - e. Subcontractor's name and address.
 - f. Supplier's name and address.
 - g. Manufacturer's name.
 - h. Specification section where the submittal is specified.
 - i. Numbers of applicable drawings and details.
 - j. Other necessary identifying information.
 - k. Use AF Form 3000 for the approval of submittal.
 - 2. When applicable, pack submittals suitably for shipment.
 - 3. Submittals to receive Contracting Officer's action marking: Provide blank space on the label or on the submittal itself for action marking; minimum 4 inches wide by 5 inches high.
- H. Transmittal of Submittals:
 - 1. Submit all submittals to the Government.

2. Submittals will be accepted from the contractor only. Submittals received from other entities will be returned without review or action.
 3. Submittals received without a transmittal form will be returned without review or action.
 - a. Project name.
 - b. Submittal date.
 - c. Transmittal number.
 - d. Specification section number.
 - e. To:
 - f. From:
 - g. Contractor's name.
 - h. Subcontractor's and supplier's names.
 - i. Manufacturer's name.
 - j. Submittal type (shop drawing, product data, sample, informational submittal).
 - k. Description of submittal.
 - l. Records of distribution.
 - m. Action marking.
 - n. Comments.
 4. Fill out a separate transmittal form for each submittal; also include the following:
 - a. Other relevant information.
 - b. Requests for additional information.
- I. NOTE ADDITIONAL INFORMATION ON RESUBMITTALS. In the event a re-submittal is required one re-submittal will be processed at no charge to the contractor.

3.03 SHOP DRAWINGS

- A. Content: Include the following information:
1. Dimensions, at accurate scale.
 2. All field measurements that have been taken, at accurate scale.

3. Names of specific products and materials used.
4. Details, identified by contract document sheet and detail numbers.
5. Show compliance with the specific standards referenced.
6. Coordination requirements; show relationship to adjacent or critical work.
7. Name of preparing firm.

B. Preparation:

1. Reproductions of contract documents are not acceptable as shop drawings.
2. Copies of standard printed documents are not acceptable as shop drawings.
3. Identify as indicated for all submittals.
4. Space for Contracting Officer's action marking shall be adjacent to the title block.

3.04 PRODUCT DATA

- A. When product data submittals are prepared specifically for this project (in the absence of standard printed information) submit such information as shop drawings and not as product data submittals.

B. Content:

1. Submit manufacturer's standard printed data sheets.
2. Identify the particular product being submitted; submit only pertinent pages.
3. Show compliance with properties specified.
4. Identify which options and accessories are applicable.
5. Include recommendations for application and use.
6. Show compliance with the specific standards referenced.
7. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
8. Identify dimensions which have been verified by field measurement.
9. Show special coordination requirements for the product.

3.05 SAMPLES

- A. Samples:

1. Provide samples that are the same as proposed product.
- B. Preparation:
 1. Attach a description to each sample.
 2. Attach name of manufacturer or source to each sample.
 3. Where compliance with specified properties is required, attach documentation showing compliance.
 4. Where there are limitations in availability, delivery, or other similar characteristics, attach description of such limitations.

3.06 REVIEW OF SUBMITTALS

- A. Submittals for approval will be reviewed, marked with appropriate action, and returned.
- B. Informational submittals: Submittals will be reviewed.
 1. "X" action: No action taken.
 2. "Not Approved" action: Revise the submittal or prepare a new submittal complying with the comments made.

3.07 RETURN, RESUBMITTAL, AND DISTRIBUTION

- A. Submittals will be returned via the Newforma website.
- B. Perform resubmittals in the same manner as original submittals; indicate all changes other than those requested by the Contracting Officer.
- C. Distribution:
 1. Distribute returned submittals to all subcontractors and suppliers involved in work covered by the submittal.
 2. Record distribution on transmittal form.

3.08 SUBMITTAL REGISTER

- A. Contractor to provide a register of submittals required under this contract. Register to include information as shown in sample register at the end of this section.

END OF SECTION 01 3001

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SCHEDULE OF MATERIAL SUBMITTALS												PROJECT NUMBER		PROJECT TITLE		SOLICITATION/CONTRACT NO.	
												BRKR 202911		Global ASNT Storage Facility		<CONTRACT #>	
TO BE COMPLETED BY PROJECT MANAGER												TO BE COMPLETED BY CONTRACT ADMINISTRATOR					
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	NO. OF COPIES REQUIRED								REQUIRED SUBMISSION DATE	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE DATE	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
		CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS				DATA	DOCUMENT \ REPORT			
	Division 1 - General Requirements																
1	Section 01 0450, Cutting and Patching, Cutting & Patching Proposal								D		NTP + 21 DAYS						
2	Section 01 0500, Field Engineering, Certificates	D									NTP + 21 DAYS						
3	Section 01 0500, Field Engineering, Record Documents									D	NTP + 21 DAYS						
4	Section 01 0500, Field Engineering, Dig Permit									D	NTP + 21 DAYS						
5	Section 01 2000, Price and Payment Procedures, Schedule of Values, FAKZ189019									D	NTP + 21 DAYS						
6	Section 01 2000, Price and Payment Procedures, Schedule of Values, FAKZ999088									D	NTP + 21 DAYS						
7	Section 01 3000, Administrative Requirements, Project Manager Resume									D	NTP + 21 DAYS						
8	Section 01 3000, Administrative Requirements, Superintendent Resume									D	NTP + 21 DAYS						
9	Section 01 3000, Administrative Requirements, Proposed Schedule									D	NTP + 21 DAYS						
10	Section 01 3000, Administrative Requirements, Pre-Construction Photos									D	NTP + 21 DAYS						
11	Section 01 3000, Administrative Requirements, Construction Quality Control Resume									D	NTP + 21 DAYS						
12	Section 01 3001, Submittals, Submittal Register									D	NTP + 21 DAYS						
13	Section 01 3329, Sustainable Design Reporting, HPSB Checklist, FAKZ189019									D	NTP + 21 DAYS						
14	Section 01 4000, Quality Requirements, Testing Agency Qualifications	D									NTP + 21 DAYS						
15	Section 01 5460, Safety and Health, Site Specific Safety and Quality Control Plan									D	NTP + 21 DAYS						
16	Section 01 5460, Safety and Health, Hazardous Material Certificates	D									NTP + 21 DAYS						
17	Section 01 5719, Temporary Environmental Controls, Finish Installation Schedule		D								NTP + 21 DAYS						
18	Section 01 6000, Product Requirements, Product Data Submittals									D	NTP + 21 DAYS						
19	Section 01 6000, Product Requirements, Shop Drawing Submittals		D								NTP + 21 DAYS						
20	Section 01 6000, Product Requirements, Sample Submittals			D							NTP + 21 DAYS						
21	Section 01 7000, Execution and Closeout Requirements, Record Documents		D							D	NTP + 21 DAYS						
22	Section 01 7000, Execution and Closeout Requirements, Demolition Plan		D								NTP + 21 DAYS						
23	Section 01 7000, Execution and Closeout Requirements, Demolition Firm Qualifications									D	NTP + 21 DAYS						
24	Section 01 7000, Execution and Closeout Requirements, Surveyor Errors & Omissions Coverage	D									NTP + 21 DAYS						
25	Section 01 7419, Construction Waste Management and Disposal, Waste Management Plan									D	NTP + 21 DAYS						

SCHEDULE OF MATERIAL SUBMITTALS										PROJECT NUMBER		PROJECT TITLE		SOLICITATION/CONTRACT NO.			
										BRKR 202911		Global ASNT Storage Facility		<CONTRACT #>			
TO BE COMPLETED BY PROJECT MANAGER										TO BE COMPLETED BY CONTRACT ADMINISTRATOR							
LINE NUMBER	ITEM OR DESCRIPTION OF ITEM, CONTRACT REFERENCE, TYPE OF SUBMITTAL	NO. OF COPIES REQUIRED								REQUIRED SUBMISSION DATE	DATE TO CIVIL ENGINEERING	RETURN SUSPENSE DATE	DATE CONTRACTOR NOTIFIED		CONTRACTOR RESUBMITTAL	FINAL APPROVAL	REMARKS
		CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS				DATA	DOCUMENT \ REPORT			
26	Section 01 7419, Construction Waste Management and Disposal, Waste Disposal Reports									D	NTP + 21 DAYS						
27	Section 01 7800, Closeout Submittals, Project Record Drawings		D								NTP + 21 DAYS						
28	Section 01 7800, Closeout Submittals, Project Record Specifications									D	NTP + 21 DAYS						
29	Section 01 7800, Closeout Submittals, Project Record Addenda									D	NTP + 21 DAYS						
30	Section 01 7800, Closeout Submittals, Project Record Change Orders									D	NTP + 21 DAYS						
31	Section 01 7800, Closeout Submittals, Project Record Reviewed Shop Drawings		D								NTP + 21 DAYS						
32	Section 01 7800, Closeout Submittals, Project Record Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
33	Section 01 7800, Closeout Submittals, Project Record Operation & Maintenance Data									D	NTP + 21 DAYS						
34	Section 01 7800, Closeout Submittals, Project Record Care & Maintenance Data									D	NTP + 21 DAYS						
35	Section 01 7800, Closeout Submittals, Project Warranties & Bonds						3				NTP + 21 DAYS						
36	Section 01 7800, Closeout Submittals, Project Attic Stock/Extra Materials										NTP + 21 DAYS						Quantity per specific specification sections
37	Section 01 7900, Demonstration and Training, Draft Training Plans									D	NTP + 21 DAYS						
38	Section 01 7900, Demonstration and Training, Training Manuals									D	NTP + 21 DAYS						
39	Section 01 7900, Demonstration and Training, Training Reports									D	NTP + 21 DAYS						
40	Section 01 7900, Demonstration and Training, Video Recordings									D	NTP + 21 DAYS						
	Division 2 - Existing Conditions																
41	Section 02 4100, Selective Demolition, Site Plan		D								NTP + 21 DAYS						
42	Section 02 4100, Selective Demolition, Demolition Plan		D								NTP + 21 DAYS						
43	Section 02 4100, Selective Demolition, Record Documents									D	NTP + 21 DAYS						
44	Section 02 4100, Selective Demolition, Demolition Firm Qualifications		D								NTP + 21 DAYS						
45	Section 02 7110, Foundation Drainage Systems, Product Data									D	NTP + 21 DAYS						
46	Section 02 7110, Foundation Drainage Systems, Sustainability Submittals									D	NTP + 21 DAYS						
47	Section 02 7110, Foundation Drainage Systems, Installer Qualifications		D								NTP + 21 DAYS						
	Division 3 - Concrete - Concrete										NTP + 21 DAYS						
48	Section 03 3000, Cast-In-Place Concrete, Product Data									D	NTP + 21 DAYS						
49	Section 03 3000, Cast-In-Place Concrete, Samples			3							NTP + 21 DAYS						
50	Section 03 3000, Cast-In-Place Concrete, Test Reports									D	NTP + 21 DAYS						
51	Section 03 3000, Cast-In-Place Concrete, Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
52	Section 03 3000, Cast-In-Place Concrete, Sustainable Design Submittal									D	NTP + 21 DAYS						
53	Section 03 3000, Cast-In-Place Concrete, Material Certificates		D								NTP + 21 DAYS						
54	Section 03 3000, Cast-In-Place Concrete, Formwork Shop Drawings		D								NTP + 21 DAYS						

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		CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS				DATA	DOCUMENT \ REPORT			
55	Section 03 3000, Cast-In-Place Concrete, Steel Reinforcement Shop Drawings		D								NTP + 21 DAYS						
56	Section 03 3000, Cast-In-Place Concrete, Design Mix								D		NTP + 21 DAYS						
57	Section 03 3000, Cast-In-Place Concrete, Installer Qualifications		D								NTP + 21 DAYS						
	Division 4 - Masonry										NTP + 21 DAYS						
58	Section 04 2000, Unit Masonry, Product Data								D		NTP + 21 DAYS						
59	Section 04 2000, Unit Masonry, Samples			3							NTP + 21 DAYS						
60	Section 04 2000, Unit Masonry, Manufacturer's Certificate		D								NTP + 21 DAYS						
61	Section 04 2000, Unit Masonry, Sustainability Submittals								D		NTP + 21 DAYS						
	Division 5 - Metals										NTP + 21 DAYS						
62	Section 05 3100, Steel Decking, Shop Drawings		D								NTP + 21 DAYS						
63	Section 05 3100, Steel Decking, Product Data								D		NTP + 21 DAYS						
64	Section 05 3100, Steel Decking, Certificates		D								NTP + 21 DAYS						
65	Section 05 3100, Steel Decking, Installation Instructions					D					NTP + 21 DAYS						
66	Section 05 3100, Steel Decking, Welder's Certificates		D								NTP + 21 DAYS						
67	Section 05 3100, Steel Decking, Installer Qualifications		D								NTP + 21 DAYS						
68	Section 05 3100, Steel Decking, Sustainability Submittals								D		NTP + 21 DAYS						
69	Section 05 4000, Cold Formed Metal Framing, Product Data								D		NTP + 21 DAYS						
70	Section 05 4000, Cold Formed Metal Framing, Shop Drawings		D								NTP + 21 DAYS						
71	Section 05 4000, Cold Formed Metal Framing, Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
72	Section 05 4000, Cold Formed Metal Framing, Sustainability Submittals								D		NTP + 21 DAYS						
73	Section 05 5000, Metal Fabrications, Shop Drawings		D								NTP + 21 DAYS						
74	Section 05 5000, Metal Fabrications, Welder's Certificates		D								NTP + 21 DAYS						
75	Section 05 5000, Metal Fabrications, Sustainability Submittal								D		NTP + 21 DAYS						
76	Section 05 5213, Pipe and Tube Railings, Shop Drawings		D								NTP + 21 DAYS						
77	Section 05 5213, Pipe and Tube Railings, Sustainability Submittal								D		NTP + 21 DAYS						
	Division 6 - Wood, Plastics, and Composites										NTP + 21 DAYS						
78	Section 06 1000, Rough Carpentry, Product Data								D		NTP + 21 DAYS						
79	Section 06 1000, Rough Carpentry, Sustainability Submittal								D		NTP + 21 DAYS						
	Division 7 - Thermal & Moisture Protection																
85	Section 07 0100, Special Project Roofing Warranty, Warranty						3				END OF CONTRACT						
86	Section 07 1113, Bituminous Dampproofing, Product Data								D		NTP + 21 DAYS						
87	Section 07 1113, Bituminous Dampproofing, Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
88	Section 07 2100, Thermal Insulation, Product Data								D		NTP + 21 DAYS						

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89	Section 07 2100, Thermal Insulation, Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
90	Section 07 2100, Thermal Insulation, Sustainability Submittal								D		NTP + 21 DAYS						
89	Section 07 4213, Ribbed Metal Wall Panels, Product Data								D		NTP + 21 DAYS						
90	Section 07 4213, Ribbed Metal Wall Panels, Shop Drawings		D								NTP + 21 DAYS						
91	Section 07 4213, Ribbed Metal Wall Panels, Samples			3							NTP + 21 DAYS						
92	Section 07 4213, Ribbed Metal Wall Panels, Warranty						D				NTP + 21 DAYS						
93	Section 07 4213, Ribbed Metal Wall Panels, Sustainability Submittal								D		NTP + 21 DAYS						
94	Section 07 4213, Ribbed Metal Wall Panels, Closeout Submittal								D		END OF CONTRACT						
95	Section 07 4213, Ribbed Metal Wall Panels, Product Test Reports								D		NTP + 21 DAYS						
96	Section 07 4213, Ribbed Metal Wall Panels, Installer Qualifications	D									NTP + 21 DAYS						
97	Section 07 4213, Ribbed Metal Wall Panels, Manufacturer's Qualifications	D									NTP + 21 DAYS						
98	Section 07 4800, Continuous Insulation Channels, Product Data								D		NTP + 21 DAYS						
99	Section 07 4800, Continuous Insulation Channels, Shop Drawings		D								NTP + 21 DAYS						
100	Section 07 4800, Continuous Insulation Channels, Structural Calculations	D									NTP + 21 DAYS						
101	Section 07 4800, Continuous Insulation Channels, Samples			3							NTP + 21 DAYS						
102	Section 07 4800, Continuous Insulation Channels, Test Reports								D		NTP + 21 DAYS						
103	Section 07 4800, Continuous Insulation Channels, Manufacturer's Qualifications	D									NTP + 21 DAYS						
104	Section 07 4800, Continuous Insulation Channels, Installer Qualifications	D									NTP + 21 DAYS						
105	Section 07 4800, Continuous Insulation Channels, Engineer Qualifications	D									NTP + 21 DAYS						
106	Section 07 5400, Thermoplastic Membrane Roofing, Product Data								D		NTP + 21 DAYS						
107	Section 07 5400, Thermoplastic Membrane Roofing, Shop Drawings		D								NTP + 21 DAYS						
108	Section 07 5400, Thermoplastic Membrane Roofing, Samples			3							NTP + 21 DAYS						
109	Section 07 5400, Thermoplastic Membrane Roofing, Manufacturer's Certificate	D									NTP + 21 DAYS						
110	Section 07 5400, Thermoplastic Membrane Roofing, Manufacturer's Installation Instructions					D					NTP + 21 DAYS						
111	Section 07 5400, Thermoplastic Membrane Roofing, Manufacturer's Field Reports								D		NTP + 21 DAYS						
112	Section 07 5400, Thermoplastic Membrane Roofing, Sustainability Submittals								D		NTP + 21 DAYS						
113	Section 07 5400, Thermoplastic Membrane Roofing, Warranty					3					END OF CONTRACT						
114	Section 07 5400, Thermoplastic Membrane Roofing, Manufacturer Qualifications	D									NTP + 21 DAYS						
115	Section 07 5400, Thermoplastic Membrane Roofing, Installer Qualifications	D									NTP + 21 DAYS						
116	Section 07 6200, Sheet Metal Flashing and Trim, Shop Drawings		D								NTP + 21 DAYS						

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117	Section 07 6200, Sheet Metal Flashing and Trim, Samples			3							NTP + 21 DAYS						
118	Section 07 6200, Sheet Metal Flashing and Trim, Sustainability Submittals								D		NTP + 21 DAYS						
119	Section 07 6200, Sheet Metal Flashing and Trim, Fabricator and Installer Qualifications	D									NTP + 21 DAYS						
120	Section 07 6200, Sheet Metal Flashing and Trim, ES-1 Verification	D									NTP + 21 DAYS						
121	Section 07 6500, Wall Flashing, Product Data								D		NTP + 21 DAYS						
122	Section 07 6500, Wall Flashing, Shop Drawings		D								NTP + 21 DAYS						
123	Section 07 6500, Wall Flashing, Test Reports								D		NTP + 21 DAYS						
124	Section 07 6500, Wall Flashing, Warranty						3				END OF CONTRACT						
125	Section 07 7100, Roof Specialties, Product Data								D		NTP + 21 DAYS						
126	Section 07 7100, Roof Specialties, Samples			3							NTP + 21 DAYS						
127	Section 07 7100, Roof Specialties, Shop Drawings		D								NTP + 21 DAYS						
128	Section 07 7100, Roof Specialties, Sustainability Submittals								D		NTP + 21 DAYS						
129	Section 07 7100, Roof Specialties, Manufacturer Qualification Data								D		NTP + 21 DAYS						
130	Section 07 7100, Roof Specialties, Product Certificates	D									NTP + 21 DAYS						
131	Section 07 7100, Roof Specialties, Product Test Report								D		NTP + 21 DAYS						
132	Section 07 7100, Roof Specialties, Sample Warranty							D			NTP + 21 DAYS						
133	Section 07 7100, Roof Specialties, Closeout Submittal										END OF CONTRACT						
134	Section 07 9005, Joint Sealers, Product Data								D		NTP + 21 DAYS						
135	Section 07 9005, Joint Sealers, Samples			3							NTP + 21 DAYS						
136	Section 07 9005, Joint Sealers, Manufacturer's Sample Warranty						D				NTP + 21 DAYS						
137	Section 07 9005, Joint Sealers, Installation Instructions				D						NTP + 21 DAYS						
138	Section 07 9005, Joint Sealers, Manufacturer Qualifications	D									NTP + 21 DAYS						
139	Section 07 9005, Joint Sealers, Applicator Qualifications	D									NTP + 21 DAYS						
140	Section 07 9005, Joint Sealers, Sustainability Submittal								D		NTP + 21 DAYS						
141	Section 07 9005, Joint Sealers, Warranty						3				END OF CONTRACT						
	Division 8 - Openings																
142	Section 08 1113, Hollow Metal Doors and Frames, Product Data								D		NTP + 21 DAYS						
143	Section 08 1113, Hollow Metal Doors and Frames, Shop Drawings		D								NTP + 21 DAYS						
144	Section 08 1113, Hollow Metal Doors and Frames, Installation Instructions				D						NTP + 21 DAYS						
145	Section 08 1113, Hollow Metal Doors and Frames, Manufacturer Qualification	D									NTP + 21 DAYS						
146	Section 08 1113, Hollow Metal Doors and Frames, Sustainability Submittals								D		NTP + 21 DAYS						
147	Section 08 3000, Oversized Hollow Metal Doors and Frames, Product Data								D		NTP + 21 DAYS						

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148	Section 08 3000, Oversized Hollow Metal Doors and Frames, Sustainability Submittals									D	NTP + 21 DAYS						
149	Section 08 3000, Oversized Hollow Metal Doors and Frames, Shop Drawings		D								NTP + 21 DAYS						
150	Section 08 3000, Oversized Hollow Metal Doors and Frames, Manufacturer's Qualifications	D									NTP + 21 DAYS						
151	Section 08 7100, Door Hardware, Product Data									D	NTP + 21 DAYS						
152	Section 08 7100, Door Hardware, Hardware Schedule		D								NTP + 21 DAYS						
153	Section 08 7100, Door Hardware, Keying Schedule		D								NTP + 21 DAYS						
154	Section 08 7100, Door Hardware, Maintenance Data								D		NTP + 21 DAYS						
155	Section 08 7100, Door Hardware, Warranty						D				END OF CONTRACT						
156	Section 08 7100, Door Hardware, Maintenance Materials								D		NTP + 21 DAYS						
157	Section 08 7100, Door Hardware, Product Test Reports									D	NTP + 21 DAYS						
158	Section 08 7100, Door Hardware, Manufacturer Qualifications	D									NTP + 21 DAYS						
159	Section 08 7100, Door Hardware, Installer Qualifications	D									NTP + 21 DAYS						
160	Section 08 7100, Door Hardware, Supplier Qualifications	D									NTP + 21 DAYS						
	Division 9 - Finishes																
164	Section 09 9113, Exterior Painting, Product Data									D	NTP + 21 DAYS						
165	Section 09 9113, Exterior Painting, Samples			3							NTP + 21 DAYS						
166	Section 09 9113, Exterior Painting, Manufacturer's Certification	D									NTP + 21 DAYS						
167	Section 09 9113, Exterior Painting, Manufacturer's Instructions					D					NTP + 21 DAYS						
168	Section 09 9113, Exterior Painting, Maintenance Data								D		NTP + 21 DAYS						
169	Section 09 9113, Exterior Painting, Manufacturer Qualifications	D									NTP + 21 DAYS						
170	Section 09 9113, Exterior Painting, Applicator Qualifications	D									NTP + 21 DAYS						
171	Section 09 9113, Exterior Painting, Maintenance Material										END OF CONTRACT						
172	Section 09 9123, Interior Painting, Product Data									D	NTP + 21 DAYS						
173	Section 09 9123, Interior Painting, Samples			3							NTP + 21 DAYS						
174	Section 09 9123, Interior Painting, Manufacturer's Certification	D									NTP + 21 DAYS						
175	Section 09 9123, Interior Painting, Manufacturer's Instructions					D					NTP + 21 DAYS						
176	Section 09 9123, Interior Painting, Sustainability Submittals									D	NTP + 21 DAYS						
177	Section 09 9123, Interior Painting, Maintenance Data								D		NTP + 21 DAYS						
178	Section 09 9123, Interior Painting, Maintenance Materials										END OF CONTRACT						
	Division 10 - Specialties																
178	Section 10 4400, Fire Protection Specialties, Manufacturer's Instructions					D					NTP + 21 DAYS						
179	Section 10 4400, Fire Protection Specialties, Maintenance Data								D		NTP + 21 DAYS						
180	Section 10 4400, Fire Protection Specialties, Sustainability Submittals								D		NTP + 21 DAYS						

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	Division 21 - Fire Protection																
181	Section 21 1313, Wet Pipe Sprinkler System, Shop Drawings		D							NTP + 21 DAYS							
182	Section 21 1313, Wet Pipe Sprinkler System, Product Data								D	NTP + 21 DAYS							
183	Section 21 1313, Wet Pipe Sprinkler System, Design Data								D	NTP + 21 DAYS							
184	Section 21 1313, Wet Pipe Sprinkler System, Test Reports								D	7 DAYS FROM TEST COMPLETION							
185	Section 21 1313, Wet Pipe Sprinkler System, Certificates	D								NTP + 21 DAYS							
186	Section 21 1313, Wet Pipe Sprinkler System, Operation and Maintenance Data								D	END OF CONTRACT							
187	Section 21 1313, Wet Pipe Sprinkler System, Closeout Submittals								D	NTP + 21 DAYS							
188	Section 21 1313, Wet Pipe Sprinkler System, Fire Protection Specialist Qualifications	D								NTP + 21 DAYS							
189	Section 21 1313, Wet Pipe Sprinkler System, Fire Protection Installer Qualifications	D								NTP + 21 DAYS							
190	Section 21 1313, Wet Pipe Sprinkler System, Extra Materials									END OF CONTRACT							
191	Section 21 1313, Wet Pipe Sprinkler System, Coordination Drawings		D							NTP + 21 DAYS							
192	Section 21 1313, Wet Pipe Sprinkler System, Water Flow Test Report								D	NTP + 21 DAYS							
193	Section 21 1313, Wet Pipe Sprinkler System, Field Quality Control Reports								D	NTP + 21 DAYS							
194	Section 21 1313, Wet Pipe Sprinkler System, Field Test Report								D	NTP + 21 DAYS							
	Division 23 - Heating, Ventilating, & Air Conditioning (HVAC)																
195	Section 23 2300, Refrigerant Piping, Product Data								D	NTP + 21 DAYS							
196	Section 23 2300, Refrigerant Piping, Shop Drawings		D							NTP + 21 DAYS							
197	Section 23 2300, Refrigerant Piping, Field Quality Control Test Reports								D	NTP + 21 DAYS							
198	Section 23 2300, Refrigerant Piping, Operation and Maintenance Data								D	NTP + 21 DAYS							
199	Section 23 8100, Decentralized Unitary HVAC Equipment, Product Data								D	NTP + 21 DAYS							
200	Section 23 8100, Decentralized Unitary HVAC Equipment, Test Reports								D	NTP + 21 DAYS							
201	Section 23 8100, Decentralized Unitary HVAC Equipment, Certificates	D								NTP + 21 DAYS							
202	Section 23 8100, Decentralized Unitary HVAC Equipment, Operation and Maintenance Data								3	END OF CONTRACT							
203	Section 23 8100, Decentralized Unitary HVAC Equipment, Closeout Submittals								3	END OF CONTRACT							
	Division 26 - Electrical																
204	Section 26 0519, Conductors and Cables, Product Data								D	NTP + 21 DAYS							
205	Section 26 0519, Conductors and Cables, Field Quality Control Reports								D	NTP + 21 DAYS							
206	Section 26 0526, Grounding and Bonding for Electrical Systems, Product Data								D	NTP + 21 DAYS							
207	Section 26 0533, Raceways and Boxes, Product Data								D	NTP + 21 DAYS							
208	Section 26 0533, Raceways and Boxes, Shop Drawings		D							NTP + 21 DAYS							

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209	Section 26 0533, Raceways and Boxes, Coordination Drawings		D							NTP + 21 DAYS							
210	Section 26 0553, Identification for Electrical Systems, Product Data								D	NTP + 21 DAYS							
211	Section 26 2726, Wiring Devices, Product Data								D	NTP + 21 DAYS							
212	Section 26 2726, Wiring Devices, Shop Drawings		D							NTP + 21 DAYS							
213	Section 26 2726, Wiring Devices, Field Quality Control Reports								D	NTP + 21 DAYS							
214	Section 26 2726, Wiring Devices, Operation and Maintenance Data								D	NTP + 21 DAYS							
215	Section 26 2813, Fuses, Product Data								D	NTP + 21 DAYS							
216	Section 26 2813, Fuses, Operation and Maintenance Data								D	NTP + 21 DAYS							
217	Section 26 2816, Disconnect Switches, Product Data								D	NTP + 21 DAYS							
218	Section 26 2816, Disconnect Switches, Shop Drawings		D							NTP + 21 DAYS							
219	Section 26 2816, Disconnect Switches, Certificates	D								NTP + 21 DAYS							
220	Section 26 2816, Disconnect Switches, Field Quality Control Reports								D	NTP + 21 DAYS							
221	Section 26 2816, Disconnect Switches, Operation and Maintenance Data								D	NTP + 21 DAYS							
218	Section 26 5100, Interior Lighting, Shop Drawings		D							NTP + 21 DAYS							
219	Section 26 5100, Interior Lighting, Product Data								D	NTP + 21 DAYS							
220	Section 26 5100, Interior Lighting, Test Reports								D	NTP + 21 DAYS							
221	Section 26 5100, Interior Lighting, Certificates	D								NTP + 21 DAYS							
	Division 28 - Electrical Safety and Security																
222	Section 28 3160, Interior Fire Alarm System, Non-Addressable, Shop Drawings		D							NTP + 21 DAYS							
223	Section 28 3160, Interior Fire Alarm System, Non-Addressable, Product Data								D	NTP + 21 DAYS							
224	Section 28 3160, Interior Fire Alarm System, Non-Addressable, Test Reports								D	NTP + 21 DAYS							
225	Section 28 3176, Interior Fire Alarm and Mass Notification System, Certificates								D	NTP + 21 DAYS							
225	Section 28 3176, Interior Fire Alarm and Mass Notification System, Operation and Maintenance Data								3	END OF CONTRACT							
225	Section 28 3176, Interior Fire Alarm and Mass Notification System, Closeout Submittals								3	END OF CONTRACT							
	Division 31 - Earthwork																
226	Section 31 0200, Temporary Erosion and Sediment Control, Certificate	D								NTP + 21 DAYS							
227	Section 31 0200, Temporary Erosion and Sediment Control, Inspection Report								D	NTP + 21 DAYS							
228	Section 31 0200, Temporary Erosion and Sediment Control, Sustainability Submittal								D	NTP + 21 DAYS							
229	Section 31 1001, Site Clearing, Record Drawings								D	END OF CONTRACT							
230	Section 31 2210, Earthwork, Material Test Reports								D	NTP + 21 DAYS							

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		CERTIFICATION OF COMPLIANCE	SHOP DRAWINGS	SAMPLES	COLOR SELECTION	MANUFACTURER'S RECOMMENDATIONS	MANUFACTURER'S WARRANTY	CATALOG DATA	OPERATING INSTRUCTIONS				DATA	DOCUMENT \ REPORT				APPROVED	DIS-APPROVED
	Division 32 - Exterior Improvements																		
231	Section 32 1314, Cement Concrete Paving, Product Data								D	NTP + 21 DAYS									
232	Section 32 1314, Cement Concrete Paving, Design Mixes								D	NTP + 21 DAYS									
233	Section 32 1314, Cement Concrete Paving, Test Reports								D	NTP + 21 DAYS									
234	Section 32 1314, Cement Concrete Paving, Certificates	D								NTP + 21 DAYS									
235	Section 32 1314, Cement Concrete Paving, Sustainability Submittals								D	NTP + 21 DAYS									
236	Section 32 1720, Pavement Joint Sealants, Product Certificates	D								NTP + 21 DAYS									
	Division 33 - Utilities																		
237	Section 33 1117, Outside Water System, Product Data								D	NTP + 21 DAYS									
238	Section 33 1117, Outside Water System, Record Drawings		D							NTP + 21 DAYS									
239	Section 33 1117, Outside Water System, Site Information								D	NTP + 21 DAYS									

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SECTION 01 3553 - SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including entry control, personnel identification, miscellaneous restrictions, and miscellaneous provisions.

1.02 RELATED REQUIREMENTS

- A. 01 0102 - Project Information & Summary

1.03 ENTRY CONTROL

- A. The contractor shall comply with all applicable installation/facility access and local security policies and procedures.
- B. Unscheduled gate closures by the Security Police may occur at any time causing all personnel entering or exiting a closed installation to experience a delay.
- C. The Contractor shall allow entrance to the Project site only to persons who have received approval by Base Security Forces.

1.04 PERSONNEL IDENTIFICATION

- A. The Government will issue personnel identification for all Contractor and Subcontractor personnel needing access to the site.
- B. The Contractor shall provide all information required for background checks to meet installation access requirements.
- C. Information required for background checks shall be provided in ample time for review by base personnel and coordinated with the proposed schedule of the work. Delay is approval, or refusal of entry, of Contractor and/or Subcontractor personnel by Base Security Forces shall not affect completion of the Work within the stipulated contract duration. No modifications in Contract Time will be considered based upon delay in approval and/or refusal of entry of Contractor and/or Subcontractor personnel by Base Security Forces.
- D. All Contractor's personnel shall display the Base issued Contractor identification badge at all times while present on site.
- E. Comply with the Government's requirements for return and/or disposal of badges at expiration of Contractor's employment on the Work.

1.05 MISCELLANEOUS PROVISIONS

- A. When operating on USAF Installations, in accordance with, AFI 10-701, Operations Security (OPSEC) Instructions. The Contractor will comply with DOD Force Protection Condition Measures, DOD Standard /Level I-AT Awareness Training, and associated tasking contained in AFI 10-245, Antiterrorism (AT) standards. Level I AT Awareness training is available for Contractor personnel and can be requested by the Base Contracting Office.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. References and standards.
- C. Testing and inspection agencies and services.
- D. Control of installation.
- E. Mock-ups.
- F. Tolerances.
- G. Manufacturers' field services.
- H. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements
- B. Section 01 3001 - Submittals
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022a.
- C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- E. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.

F. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Testing Agency Qualifications:
 - 1. Prior to the start of Work, submit agency name, address, telephone number, and names of full time registered Engineer and responsible Officer.
- C. Design Data: Submit for the Government's knowledge for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for the Government's information.
- D. Report/Inspection Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making the inspection or test.
 - 6. Designation of the Work and test method.
 - 7. Identification of product and Specification Section.
 - 8. Complete inspection or test data.
 - 9. Test results and an interpretation of test results.
 - 10. Ambient conditions at the time of sample-taking and testing.
 - 11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting.

14. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Government, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
 15. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to the Government, in quantities specified for Product Data.
1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to the Government.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Government's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for the Government's benefit.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- H. Erection Drawings: Submit drawings for Government's benefit.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.

- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Beneficial Occupancy.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Government before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Government shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
- D. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - 1. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
- E. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - 1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - 2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - 3. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

- 4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
- 5. Security and protection of samples and test equipment at the Project site.
- F. The Government Responsibilities: The Government will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are specifically noted as the Government's responsibility. If not specifically noted as the Government's responsibility, the Contractor shall provide these services.
- G. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

PART 2 PRODUCTS - N/A

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from the Government before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by the Government and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by the Government.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Government before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. The contractor shall provide all testing, inspections, and similar services; these services also include those specified to be performed by an independent agency.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with the Government and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify the Government and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by the Government.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter or enlarge on requirements of Contract Documents
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.

4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
2. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
3. Notify Government and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
4. When required, employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Government.

- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.

END OF SECTION

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SECTION 01 4100 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCED STANDARDS:

- A. Regulatory requirements applicable to this project are the following:
1. All applicable National, State and Local Codes
 2. Alabama State Fire Marshall
 3. 117th Air Refueling Wing Fire Department
 4. Birmingham-Shuttlesworth International Airport Master Plan Design Data
 5. Americans with Disability Act Accessibility Guidelines (ADAAG), Current Edition
 6. ICC/ANSI A117.1-2003 Design Guidelines for Accessible and Usable Building Facilities
 7. OSHA
 8. All Applicable Sections of the US Code of Federal Regulations
 - a. 28 CFR 35 Department of Justice Accessibility Regulations Relating to State and Local Governments
 - 1) 28 CFR 36 Department of Justice Accessibility Regulations Relating to Public Accommodations.
 - 2) 29 CFR 1910 Occupational Safety and Health Standards
 - 3) 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
 - b. FED-STD-795 - Uniform Federal Accessibility Standards; 1988.
 9. All applicable Engineering Technical Letters (ANGETL)
 - a. ANGETL 15-01-00 ANG Design Policy
 - b. ANGETL 15-01-02 SCIF and ATFP Guidance
 - c. ANGETL 15-01-03 Fire Protection and Design
 - d. ANGETL 15-01-04 Mechanical Engineering

- e. ANGETL 15-01-05 Electrical and Communications Engineering
- f. ANGETL 15-01-06 Roof Design Guidance
- g. ANGETL 15-01-07 Airfield and Vehicle Pavement
- 10. Air National Guard Handbook (ANGH) 32-1084, Facility Space Standards
- 11. All Applicable Sections of the United Facilities Criteria
 - a. Series 1:200; UFC 1-200-01, UFC 1-200-02
 - b. Series 3-100: UFC 3-101-01, 3-110-03, 3-120-01, 3-120-10, 3-190-06
 - c. Series 3-200: UFC 3-201-01, 3-201-02, 3-210-10, 3-220-01, 3-250-01, 3-250-04, 3-250-11
 - d. Series 3-300: UFC 3-301-01
 - e. Series 3-400: UFC 3-400-02, 3-401-01, 3-410-01, 3-410-02, 3-430-01FA, 3-470-01
 - f. Series 3-500: UFC 3-501-01, 3-520-01, 3-530-01, 3-550-01, 3-570-01
 - g. Series 3-600: UFC 3-600-01
 - h. Series 4-000: UFC 4-021-01
- 12. All National Fire Protection Association (NFPA) codes and standards referenced by Unified Facilities Criteria (UFC).
- 13. All model codes and standards developed by the International Code Council (ICC) referenced by Unified Facilities Criteria (UFC).
 - a. International Building Code, edition referenced in applicable UFC.
 - 1) International Fire Code, edition referenced in applicable UFC.
 - 2) International Fuel Gas Code, edition referenced in applicable UFC.
 - 3) International Mechanical Code, edition referenced in applicable UFC.
 - 4) International Plumbing Code, edition referenced in applicable UFC.
 - 5) International Electrical Code, edition reference in applicable UFC.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements.

1.03 QUALITY ASSURANCE

- A. Contractor's Designer Qualifications: Refer to Section - 01 4000 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 4217 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including requirements of the Government's Solicitation and other Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the General Conditions.
- B. Indicated refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.
- C. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Government", "requested by the Government", and similar phrases. However, no implied meaning shall be interpreted to extend the Government's responsibility into the Contractor's area of construction supervision.
- D. A.D.A.--American Disabilities Act of July 26, 1991 and all revisions to date.
- E. Approve: The term "approved," where used in conjunction with the Government's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Government as stated in Solicitation Requirements. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
- F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
- G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
- H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

- I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
- J. The term "experienced," when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.
- K. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.
- L. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
- B. Abbreviated Language: Language used in the Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and where the full context of the Contract Documents so indicates.
- C. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.

- B. **Conflicting Requirements:** Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Government for a decision before proceeding
- C. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

END OF SECTION

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SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

- A. Section 01 3553 - Security Procedures
- B. Section 01 5100 - Temporary Utilities.
- C. Section 01 5500 - Vehicular Access and Parking.

1.03 TEMPORARY UTILITIES - See Section 01 5100

1.04 TELECOMMUNICATIONS SERVICES

- A. Refer to Superintendent Requirements listed in 01 3000 - Administrative Requirements for telecommunications requirements.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
 - 1. Use of existing facilities is not permitted.
- B. Maintain daily in clean and sanitary condition.

1.06 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Government-occupied areas, to prevent penetration of dust and moisture into Government-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.07 VEHICULAR ACCESS AND PARKING - See Section 01 5500

1.08 WASTE REMOVAL

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site daily.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.09 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Beneficial Occupancy inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. No underground installations for temporary utilities are permitted on the site without written approval by the Contracting Officer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5100 - TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from Contractor provided portable power generation source. Use of existing facility power distribution systems for construction purposes is not permitted.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts. Use of permanent equipment for temporary cooling purposes shall not affect the specified warranty periods for equipment. All equipment shall be warranted for specified warranty period starting with the date of Beneficial Occupancy.

1.08 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.
- B. Provide temporary ventilation as required to maintain specified conditions for construction operations and as required by applicable laws and regulations to maintain a safe and healthy work environment.

1.09 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By the Government.
- B. Connect to existing water source.
 - 1. Exercise measures to conserve water.
- C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5460 - SAFETY AND HEALTH

PART 1 GENERAL

1.01 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. Code of Federal Regulations (CFR):
 - 1. OSHA General Industry Safety and Health Standards (29 CFR 1910), Publication V2206; OSHA Construction Industry Standards (29 CFR 1926). One source of these regulations is OSHA Publication 2207, which includes a combination of both Parts 1910 and 1926 as they relate to construction safety and health. It is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
 - 2. National Emission Standards for Hazardous Air Pollutants (40 CFR, Part 61).
 - 3. Environmental Protection Agency (EPA) Final Rule (40 CFR Part 761) dated July 17, 1985.
- C. Federal Standard (Fed. Std):
 - 1. 313A Material Safety Data Sheets, Preparation and the Submission of.

1.02 WORK COVERED BY THIS SECTION

- A. This section is applicable to all work covered by this contract.

1.03 DEFINITION OF HAZARDOUS MATERIALS

- A. Refer to hazardous and toxic materials/substances included in Subparts H and Z of 29 CFR 1910; and to others as additionally defined in Fed. Std. 313. Those most commonly encountered include asbestos, polychlorinated biphenyls (PCB'S), explosives, and radioactive material, but may include others. The most likely products to contain asbestos are sprayed-on fireproofing, insulation, boiler lagging, pipe covering and likely products to contain PCB's are transformers, capacitors, voltage regulators, and oil switches.

1.04 QUALITY ASSURANCE

- A. **Safety Meeting:** Representatives of the Contractor shall meet with the Contracting Officer and his/her representative(s) prior to the start of work under this contract for the purpose of reviewing the Contractor's safety and health programs and discussing implementation of all safety and health provisions pertinent to the work to be performed under the contract. The Contractor shall be prepared to discuss, in detail, the measures he/she intends to take in order to control any unsafe or unhealthy conditions associated with the work to be performed under the contract. If directed by the Contracting Officer, this meeting may be held in conjunction with other meetings which are scheduled to take place prior to start of work under this contract. The level of detail for the safety meeting is dependent upon the nature of the work and the potential inherent hazards. The Contractor's principal on-site representative(s), the general superintendent and his/her safety representative(s) shall attend this meeting.
- B. **Compliance With Regulations:** All work, including contact with and handling of hazardous materials, the disturbance or dismantling of structures containing hazardous materials and/or the disposal of hazardous materials shall comply with the applicable requirements of 29 CFR 1926/1910 and 40 CFR 761. Work involving the disturbance, dismantling of asbestos or asbestos containing materials; the demolition of structures containing asbestos; and/or the disposal and removal of asbestos, shall also comply with the requirements of 40 CFR, Part 61, Subparts A and M. All work shall comply with applicable state and municipal safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall apply.
- C. **Contractor Responsibility:** The Contractor shall assume full responsibility and liability for compliance with all applicable regulations pertaining to the health and safety of personnel during the execution of work, and shall hold the Government harmless for any action on his/her part or that of his/her employees or subcontractors, which results in illness, injury or death.
- D. **The contractor shall provide and submit a site specific Safety Plan and Quality Control Plan for review and approval by the Government.**

1.05 SUBMITTALS

- A. **Accident Reporting:** A copy of each accident report, which the Contractor or subcontractors submit to their insurance carriers, shall be forwarded through the Construction Engineer to the Contracting Officer as soon as possible, but in no event later than seven (7) calendar days after the day the accident occurred.
- B. **Permits:** If hazardous materials are disposed of off site, submit copies of permits from applicable, Federal, state, or municipal authorities and necessary certificates that the material has been disposed of as per regulations.

- C. Other Submittals: If agreed to in writing at the safety meeting, other submittals shall be required. One such submittal which may be included is a plan of action for handling hazardous materials, which shall contain the following:
1. Number, type, and experience of employees to be used for the work.
 2. Description of how applicable safety and health regulations and standards are to be met.
 3. Type of protective equipment and work procedures to be used.
 4. Emergency procedures for accidental spills or exposures.
 5. Procedures for disposing of or storing the toxic/hazardous materials.
 6. Identification of possible hazards, problems, and proposed control mechanisms.
 7. Protection of public or others not related to the operation.
 8. Interfacing and control of subcontractors, if any.
 9. Identifications of any required analyses, test demonstrations, and validation requirements.
 10. Method of certification for compliance.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Special facilities, devices, equipment, clothing, and similar items used by the Contractor in the execution of work shall comply with the applicable regulations.

2.02 HAZARDOUS MATERIALS

- A. The Contractor shall bring to the attention of the Contracting Officer any material suspected of being hazardous which he/she encounters during execution of the work. A determination will be made by the Contracting Officer as to whether the Contractor shall Perform tests to determine if the material is hazardous. If the Contracting Officer directs the Contractor to perform tests, and/or if the material is found hazardous and additional protective measures are needed, a contract change may be required, subject to applicable provisions of this contract.

PART 3 EXECUTION

3.01 STOP WORK ORDERS

- A. When the Contractor or his/her subcontractors are notified by the Contracting Officer's representative(s) of any noncompliance with the provisions of the contract and the action(s) to be taken, the Contractor shall immediately, if so directed, or within 48 hours after receipt of a notice of violation correct the unsafe or unhealthy condition. If the Contractor fails to comply promptly, all or any part of the work being performed may be stopped by the Contracting Officer or his/her representative(s) with a "Stop Work Order." When, in the opinion of the Contracting Officer or his/her representative(s), satisfactory corrective action has been taken to correct the unsafe and unhealthy condition, a start order will be given immediately. The Contractor shall not be allowed any extension of time or compensation for damages by reason of or in connection with such work stoppage.

3.02 PROTECTION

- A. The Contractor shall take all necessary precautions to prevent injury to the public, building occupants, or damage to property of others. For the purposes of this contract, the public or building occupants shall include all persons not employed by the Contractor or a subcontractor working under his/her direction.
- B. Storing, positioning or use of equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public or building occupants by its accidental shifting, ignition, or other hazardous qualities is prohibited.
- C. Obstructions: No corridor, aisle, stairway, door, or exit shall be obstructed or used in such a manner as to encroach upon routes of ingress or egress utilized by the public or building occupant, or to present unsafe or unhealthy condition to the public or building occupant.
- D. Work shall not be performed in any area occupied by the public or Federal employees unless specifically permitted by the contract or the Contracting Officer and unless adequate steps are taken for the protection of the public or Federal employees.
- E. Wherever practicable, the work area shall be fenced, barricaded, or otherwise blocked off from the public or building occupants to prevent unauthorized entry into the work area.
- F. Alternate Precautions: When the nature of the work prevents isolation of the work area and the public or building occupants may be in or pass through, under or over the work area, alternate precautions such as the posting of signs, the use of signal persons, the erection of barricades or similar protection around particularly hazardous operations shall be used as appropriate.

- G. Public Thoroughfare: When work is to be performed over a public thoroughfare such as a sidewalk, lobby, or corridor, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screens or barricades. When the exposure to heavy falling objects exists, as during the erection of building walls or during demolition, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.
- H. Fences and barricades shall be removed upon completion of the project, in accordance with local ordinance and to the satisfaction of the Contracting Officer or his/her representative(s).

END OF SECTION

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SECTION 01 5500 - VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Construction parking controls.
- E. Flag persons.
- F. Haul routes.
- G. Traffic signs and signals.
- H. Maintenance.
- I. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

- A. Section 01 0102 Project Information and Summary

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Construction: Contractor's option.
- B. Materials for Permanent Construction: As specified in product specification sections, including topping.

2.02 SIGNS, SIGNALS, AND DEVICES

- A. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- B. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 ACCESS ROADS

- A. Use of existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.

- C. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.
- D. Provide and maintain access to fire hydrants free of obstructions.

3.02 PARKING

- A. Use of designated areas of existing parking facilities by construction personnel is permitted.

3.03 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Government's operations.
- B. Prevent parking on or adjacent to access roads or in non-designated areas.

3.04 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.05 HAUL ROUTES

- A. Confine construction traffic to designated haul routes as approved by the Government.
- B. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.
- C. Keep all haul roads clean and free of foreign objects debris. Refer to Part 3.08 below.

3.06 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Relocate as work progresses, to maintain effective traffic control.

3.07 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.08 MUD FROM SITE VEHICLES

- A. All vehicles accessing the site shall be free of mud and other debris prior to entering the site to prevent foreign object debris (FOD) from inhibiting operations of the base.
- B. Routinely clean site paving and haul roads to remove all loose dirt and possible FOD. Coordinate with Government representatives to maintain acceptable levels.
- C. The Government reserves the right to request vehicles be clean and/or removed from the premises due to FOD debris concerns.

END OF SECTION

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SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Limited Source Product Requirements.
- E. Substitution limitations.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 00 0102 - Project Information and Summary
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.
- C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Government, or otherwise indicated as to remain the property of the Government, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Made outside the United States, its territories, Canada, or Mexico.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Made of wood from newly cut old growth timber.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
 - 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 4. Have longer documented life span under normal use.
 - 5. Result in less construction waste. See Section 01 7419
 - 6. Are made of recycled materials.
 - 7. Have a published GreenScreen Chemical Hazard Analysis.
- D. Regionally-Sourced Products:
 - 1. Overall Project Requirement: LEED Meritable.
 - a. The Project is not registered with the USGBC nor is it pursuing certification.
 - b. The contractor will not be required to submit credit compliance documentation via the USGBC LEED online system.

2. The Contractor shall give preference to Regionally-Sourced Products meeting the requirements of LEED Credit MR 5.2.
 3. Contractor shall submit documentation from product manufacturer(s) documenting each product's ability to meet the requirements of LEED Credit MR 5.2 for internal project documentation purposes.
- E. Products with Rapidly Renewable Material Content:
1. Overall Project Requirement: LEED Meritable.
 - a. The Project is not registered with the USGBC nor is it pursuing certification.
 - b. The contractor will not be required to submit credit compliance documentation via the USGBC LEED online system.
 2. The Contractor shall give preference to products containing Rapidly Renewable Material meeting the requirements of LEED Credit MR 6.
 3. Contractor shall submit documentation from product manufacturer(s) documenting each product's ability to meet the requirements of LEED Credit MR 6 for internal project documentation purposes.
- F. Products with Recycled Content:
1. Overall Project Requirement: LEED Meritable.
 - a. The Project is not registered with the USGBC nor is it pursuing certification.
 - b. The contractor will not be required to submit credit compliance documentation via the USGBC LEED online system.
 2. The Contractor shall give preference to products containing Recycled Content meeting the requirements of LEED Credit MR 4.
 3. Contractor shall submit documentation from product manufacturer(s) documenting each product's ability to meet the requirements of LEED Credit MR 4 for internal project documentation purposes.

2.03 LIMITED SOURCE PRODUCT REQUIREMENTS

- A. The following products/manufacturers are required to be provided, by name, with substitutions not allowed:

1. Existing fire alarm / mass notification system is a "Notifier" system by Honeywell. Contractor to coordinate with Honeywell and ensure new fire alarm devices provided are compatible with existing FA/MNS equipment/system intended to remain.
- B. Refer to the Government's limited source justification(s) included with the project solicitation for additional information.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. Government will consider requests for substitutions only within 30 days after date established in Notice to Proceed.
 1. Substitutions received after this time period may be considered or rejected at the discretion of the Government.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Government.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

- E. Conditions: The Contractor's substitution request will be received and considered by the Government only when one or more of the following conditions are satisfied, as determined by the Government; otherwise requests will be returned without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 5. A substantial advantage is offered the Government, in terms of cost, time, energy conservation or other considerations of merit
 6. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 7. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 8. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- F. The Government reserves the right to reject any substitutions.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. If approved by the Government, provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- J. Comply with manufacturer's warranty conditions, if any.
- K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

- L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- M. Prevent contact with material that may cause corrosion, discoloration, or staining.
- N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- P. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
- Q. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
- R. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- S. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

END OF SECTION

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**SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT
RESTRICTIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. VOC restrictions for product categories listed below under "DEFINITIONS."
- B. All products of each category that are installed in the project must comply; The Government's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

- A. Section 01 3001 - Submittas: Submittal procedures.
- B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
 - 1. Adhesives, sealants, and sealer coatings.
 - 2. Paints and coatings.
 - 3. Insulation.
 - 4. Composite wood and agrifiber products used either alone or as part of another product.
 - 5. Other products when specifically stated in the specifications.
- B. Interior of Building: Anywhere inside the exterior weather barrier.
- C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.04 REFERENCE STANDARDS

- A. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2 2017.
- C. CRI (GLCC) - Green Label Testing Program - Approved Product Categories for Carpet Cushion; Carpet and Rug Institute; Current Edition.
- D. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- E. UL (GGG) - GREENGUARD Gold Certified Products; UL Environment; current listings at <http://http://productguide.ulenvironment.com/QuickSearch.aspx>.
- F. GreenSeal GS-36 - Standard for Adhesives for Commercial Use 2013.
- G. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).
- H. SCS (CPD) - SCS Certified Products Current Edition.
- I. ASHRAE 189.1 - Standard for the Design of High-Performance Green Buildings

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.
 - 1. Evidence of Compliance: Acceptable types of evidence are:

- a. Current GREENGUARD Children & Schools certification;
www.greenguard.org.
 - b. Current SCS Indoor Advantage Gold certification; www.scs-certified.com.
 - c. Product listing in the CHPS Low-Emitting Materials Product List at
www.chps.net/manual/lem_table.htm.
 - d. Current certification by any other agencies acceptable to CHPS.
 - e. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
- B. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
 - c. Certification by manufacturer that product complies with requirements.
- C. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GreenSeal Certification.
 - b. Report of laboratory testing performed in accordance with GreenSeal GS-36 requirements.
 - c. Published product data showing compliance with requirements.
- D. Paints and Coatings:
1. Provide coatings that comply with the most stringent requirements specified in the following:

- a. Provide flat and non flat topcoats, primers, undercoaters, and anti-corrosive coatings products having volatile organic compounds (VOC) content not greater than required by Green Seal Standard GS-11
 - b. Concrete/masonry sealers (waterproofing concrete/masonry sealers), concrete curing compounds, dry fog coatings, faux finishing coatings, fire resistive coatings, floor coatings, graphic arts (sign) coatings, pretreatment wash primers, reactive penetrating sealers, recycled coatings, shellacs (clear and opaque), specialty primers, stains, wood coatings (clear and opaque), specialty primers, stains, wood coatings (clear wood finishes), wood preservatives, and zinc primer products having volatile organic compounds (VOC) content not greater than required by California Air Resources Board Suggested Control Measure for Architectural Coatings or SCAQMD Rule 1113
 - c. Basement specialty coatings, high-temperature coatings, low solids coatings, stone consolidants, swimming-pool coatings, tub- and tile-refining coatings, and waterproofing membrane products having volatile organic compounds (VOC) content not greater than required by California Air Resources Board Suggested Control Measure for Architectural Coatings.
2. Determination of VOC Content:
- a. Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
3. Evidence of Compliance: Acceptable types of evidence are:
- a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
 - c. Certification by manufacturer that product complies with requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. The Government reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to the Government.

- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

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SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Dust Control.
- D. Pre-installation meetings.
- E. Cutting and patching.
- F. Surveying for laying out the work.
- G. Cleaning and protection.
- H. Starting of systems and equipment.
- I. Demonstration and instruction of Government personnel.
- J. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- K. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 0102 - Project Information & Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. See Section 01 3001 - Submittals, for submittal procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- E. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

- G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- H. Section 02 4100 - SELECTIVE DEMOLITION

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Include in request:
 - a. Identification of Project.

- b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Date and time work will be executed.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Government. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
 - 4. Refer to Division 31 Specifications for additional requirements.
- E. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Government occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Government's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Government four business days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.

- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Contracting Officer Representative(s), other meeting participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify the Government of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to the Government the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Government.
- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.

- M. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- N. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction. Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with Base Civil Engineering via the Contracting Officer Representative.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Government before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
- C. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 2. Remove items indicated on drawings.
 3. Relocate items indicated on drawings.
 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Verify that abandoned services serve only abandoned facilities.
 3. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Government.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Government review and request instructions.
 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Refer to Specification Section 01 0450 for additional requirements.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 7900 - Demonstration and Training.
- B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Government's personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- D. Demonstration to include identification of air filter locations and filter replacement procedures.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

- A. Execute final cleaning after Beneficial Occupancy but before making final application for payment.
- B. Use cleaning materials that are nonhazardous.
- C. 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.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and any other roof or drainage elements.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Beneficial Occupancy.
- B. Refer to requirements of the contract for additional requirements
- C. Beneficial Occupancy
 - 1. Notify Government when work is considered ready for Government's Beneficial Occupancy inspection.
 - 2. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Government's Beneficial Occupancy inspection.
 - 3. Notify the Government of intended date of Beneficial Occupancy as early as is feasibly possible. The Government will schedule Final Inspection of the work with the Contracting Officer, Contracting Officer's Representative(s), Architect, Architect's Consultants, Base Fire Department, and other required attendees.
 - 4. Upon completion of the Final Inspection, if the work is deemed to achieve beneficial occupancy, the Government will distribute a Certificate of Beneficial Occupancy with "Punch List" of items required to be corrected by the Contractor prior to Final Acceptance of the Work.
- D. Final Acceptance
 - 1. Correct items of work listed in executed Certificates of Beneficial Occupancy.
 - 2. Notify the Government when work is considered finally complete.
 - 3. Submit a certified copy of the final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Government.
 - 4. Upon completion of reinspection, the Government will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 - 5. If necessary, reinspection will be repeated until all items of work are completed.
 - 6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

7. Submit the final payment request with releases and supporting documentation as outlined in the Construction Contract.
- E. Conduct Beneficial Occupancy inspection and create Final Correction Punch List containing Government's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Government.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Beneficial Occupancy or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Government.

END OF SECTION

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SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Government requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may NOT be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood: May be used as blocking or furring.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
 - 6. Concrete.
 - 7. Bricks.
 - 8. Concrete masonry units.
 - 9. Asphalt paving.
 - 10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 11. Glass.
 - 12. Gypsum drywall and plaster.
 - 13. Plastic buckets.

14. Carpet, carpet cushion, carpet tile, and carpet remnants , both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
15. Paint.
16. Plastic sheeting.
17. Rigid foam insulation.
18. Windows, doors, and door hardware.
19. Plumbing fixtures.
20. Mechanical and electrical equipment.
21. Fluorescent lamps (light bulbs).
22. Acoustical ceiling tile and panels.
- E. Project waste diversion goal is 60 percent, by weight or volume, of potential landfill trash/waste by recycling and/or salvage.
- F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- H. Methods of trash/waste disposal that are not acceptable are:
 1. Burning on the project site.
 2. Burying on the project site.
 3. Dumping or burying on other property, public or private.
 4. Other illegal dumping or burying.
 5. Incineration, either on- or off-site.
- I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. See Section 01 3001 - Submittals: Additional requirements for project meetings, reports, submittal procedures and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.

- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Submit Waste Management Plan within 10 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.

6. **Transportation:** Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 7. **Recycling Incentives:** Describe procedures required to obtain credits, rebates, or similar incentives.
- D. Waste Disposal Reports:** Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Government.
 3. **Landfill Disposal:** Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. **Recycled and Salvaged Materials:** Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 5. **Material Reused on Project:** Include the following information for each:

- a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator as project requires.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.06 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3001 - Submittals, for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Government, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.

2. Provide containers as required.
 3. Locate enclosures out of the way of construction traffic.
 4. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 5. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

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SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3001 - Submittals. Submittal procedures, show drawings, product data, and samples
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Government with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit one electronic copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Government comments. Revise content of all document sets as required prior to final submission.
 - 2. Submit one electronic set of revised final documents in final form within 10 days after final inspection.
 - a. Where data includes images, video, or other media type, submit in electronic file format compatible and appropriate for the media type. Coordinate with the Contracting Officer Representative to ensure proposed media type is compatible with the Government's electronic equipment and can be viewed successfully by the Government.
- C. Warranties and Bonds:

1. Make other submittals within 10 days after Date of Beneficial Occupancy, prior to final Application for Payment.
2. For items of Work for which acceptance is delayed beyond Date of Beneficial Occupancy, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
3. Submit warranties and bonds in both hard copy and electronic format.
 - a. Provide warranties in .pdf format and included with other record, operation and maintenance data organized by specification section.
- D. Contractor shall burn to disk (CD and/or DVD) all close out documentation required to be in electronic format.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Government.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on original Contract drawings.
- G. The Government will review project record documents on a monthly basis to ensure changes in the work are being accurately recorded.
- H. Upon completion of the work, all project record documents shall be transferred into electronic (.pdf and .dwg) format files for submission to the Government.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- E. Submit in electronic format as described in Part 1 above.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.

2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.
- F. Submit in electronic format as described in Part 1 above.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.

- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- L. Include test and balancing reports.
- M. Additional Requirements: As specified in individual product specification sections.
- N. Submit in electronic format as described in Part 1 above.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Government's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual in electronic (.pdf) format including electronic tabs for ease of navigation.
- E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Government, Consultants, Contractor and subcontractors, with names of responsible parties.
- G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- H. Arrange content by systems under section numbers and sequence of Table of Contents of the Project Specifications.

- I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Government, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Certificates.
 - c. Photocopies of warranties and bonds.
- J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- K. Combine all of the above listed documents into a tabbed and organized electronic file in .pdf format for review. Update the electronic file as requested by the Government until documents are complete and acceptable to the Government. Following acceptance of the electronic file, print and bind one hard copy, as described above, and deliver it to the Government.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Government's permission, leave date of beginning of time of warranty until Date of Beneficial Occupancy is determined.

- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- I. Combine all of the above listed documents into a tabbed and organized electronic file in .pdf format for review. Update the electronic file as requested by the Government until documents are complete and acceptable to the Government. Following acceptance of the electronic file, print and bind one hard copy, as described above, and deliver it to the Government.

END OF SECTION

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SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Government personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical Systems and equipment.
 - 5. Items specified in individual product Sections.
- C. Training of Government personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: The Government will designate personnel to be trained; tailor training to needs and skill-level of attendees.
1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 2. Submit not less than four weeks prior to start of training.
 3. Revise and resubmit until acceptable.
 4. Provide an overall schedule showing all training sessions.
 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such a slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
1. Identification of each training session, date, time, and duration.
 2. Sign-in sheet showing names and job titles of attendees.
 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for the Government's subsequent use.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by the Government.
- B. Demonstration may be combined with Government personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Beneficial Occupancy.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Beneficial Occupancy.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. The Government will provide classroom and seating at no cost to Contractor.
- C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- D. Provide training in minimum two hour segments.
- E. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- F. Training schedule will be subject to availability of Government personnel to be trained; re-schedule training sessions as required by the Government; once schedule has been approved by the Government failure to conduct sessions according to schedule will be cause for the Government to charge Contractor for personnel "show-up" time.
- G. Training schedule will be subject to availability of Government personnel to be trained; re-schedule training sessions as required by the Government.
- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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SECTION 02 4100 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.
- B. Abandonment and removal of existing utilities and utility structures.
- C. Dustproofing

1.02 RELATED REQUIREMENTS

- A. Section 00 0102 - Project Information and Summary
- B. Section 01 5000 - Temporary Facilities and Controls
- C. Section 01 7000 - Execution and Closeout Requirements
- D. Section 01 7419 - Construction Waste Management and Disposal

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
 - 4. Demolition Plan shall include a detailed project schedule which incorporates the project phasing requirements and durations identified in Section 00 0102, Project Information and Summary.

- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove items as indicated on the drawings.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Government.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.

- D. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. If hazardous materials are discovered during removal operations, stop work and notify the Contracting Officer; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
 - 3. Refer to specification Section 01 7419, Construction Waste Management and Disposal.

3.03 EXISTING UTILITIES

- A. Protect existing utilities to remain from damage.
- B. Apply for and receive dig permit from base civil engineering prior to beginning any excavation. Coordinate with Contracting Officer Representative regarding dig permit application requirements and approval time frames.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Government.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Government.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.
- I. Do not disrupt utilities without written authorization from designated base personal. Coordinate required utility disruptions to limit impact on base personnel.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Contracting Officer before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site daily.
- B. Leave site in clean condition, ready for subsequent work.
- C. Conceal all debris, junk, trash, and demolished materials inside the building or in closed lid exterior containers so as to prevent dust and debris from becoming air borne.
- D. When required, or when directed by contracting officer, wet down all debris, junk, trash, and demolished materials immediately prior to removal of these materials from the project site as required to prevent dust and debris from becoming air borne during transfer of materials from storage containers to vehicle intended to remove the materials from the site.
- E. Refer to specification Section 01 7419, Construction Waste Management and Disposal.

3.06 DUSTPROOFING

- A. Contractor will be required to erect temporary dust partitions around areas/ equipment intended to remain in service during the work included in this project.
- B. All temporary dust partitions will be required to remain in good repair throughout the duration of the project.
 1. Dust partitions will be reviewed by base personnel on a weekly basis. Contractor will be required to make repairs to dust partitions as requested by base personnel.
- C. Phasing and Dustproofing Plan:

1. Prior to beginning demolition, Contractor will be required to submit a phasing and dustproofing plan indicating how the Contractor intends to phase the work as required to keep in service all areas/systems/equipment which are required to remain operation during the work of this contract, as well as proposed measures to protect existing areas/systems/equipment intended to remain in service.
2. Plan shall indicate all applicable materials and construction methods intended to be used to erect temporary dustproofing partitions.
3. Plan shall indicate means, methods, and proposed timing for removal of temporary dustproofing. Timing of temporary dustproofing shall be coordinated with and included as a line item in the Contractor's construction schedule.
4. Submit plan to Contracting Officer well in advance of proposed demolition activities to allow sample time for review by base personnel.

END OF SECTION

SECTION 02 7110 - FOUNDATION DRAINAGE SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's solicitation requirements apply to this Section.
- B. Section 01 6000 - Product Requirements

1.02 SUMMARY

- A. This Section includes foundation, subsoil drainage systems.
- B. Related Sections. The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section "Earthwork" for excavating, trenching, and backfilling.
 - 2. Division 3 Section "Cast-in-Place Concrete" for concrete cleanout anchors.
 - 3. Division 7 Section for waterproofing.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Solid pipe for tight joints.
 - 2. Perforated piping.
 - 3. Drainage conduits.
- C. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Total weight of products provided

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed foundation drainage systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.05 COORDINATION

- A. Coordinate foundation drainage system installation with excavating, trenching, and backfilling.
- B. Coordinate piping termination with storm drainage system.

1.06 PROJECT CONDITION

- A. Site Information: Verify all existing utility conditions.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1.07 SUSTAINABILITY REQUIREMENTS

- A. Materials specified shall have a post-consumer content as follows:
 - 1. Steel - Recycled Content: 30% Post-consumer content, minimum.
 - 2. HDPE - Recycled Content: 100% Post-consumer content, minimum.
 - 3. PVC - Recycled Content: 5% Post-consumer content, minimum.

PART 2 PRODUCTS

2.01 PIPES AND FITTINGS

- A. General: Include pipes, fittings, couplings, and joint materials.
- B. Cast-Iron Soil Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes, hub-and-spigot ends, gray, cast iron, for gasketed joints.
 - 1. Gaskets: ASTM C 564, rubber, of thickness matching class of pipe.
- C. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal.

- D. Perforated, Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.02 SPECIAL PIPE COUPLINGS

- A. Description: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined. Include the following specific sleeve materials, where available:
 - 1. Cast-Iron Soil Pipe: ASTM C 564, rubber.
 - 2. Plastic Pipe: ASTM F 477, elastomeric seal.
 - 3. Dissimilar Pipes: Compatible with pipe materials being joined.
 - 4. Bands: Stainless steel, at least 1 at each pipe insert.

2.03 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53; Type F or Type E, Grade A; Schedule 40; galvanized.
- B. Cast-Iron Sleeves: Cast or fabricated wall pipe with integral water stop, made for this application.
- C. Cast-Iron Pipe Sleeves: ASTM A 74, Service class, cast-iron soil pipe.

2.04 DRAINAGE CONDUITS

- A. Description: Smooth, rigid, perforated, polyvinyl chloride (PVC) conduit system, with fittings. Conduit system is equivalent to ASTM D 2729 PVC piping.
 - 1. Conduit: Extruded from ASTM D 4216, PVC compound material. Special fittings with outlet include 4-inch outlet connection.
 - 2. Minimum Flow Rate: Equal to or greater than 4-inch.
 - 3. Couplings: PVC fittings.

2.05 SOIL MATERIALS

- A. Impervious Fill: Clayey gravel and sand mixture capable of compacting to dense state.
- B. Aggregate Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2 inch sieve and not more than 5 percent passing No. 8 sieve.

- C. Granular Fill Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with no more than 50 percent passing No. 50 sieve and no more than 5% passing the No. 200 sieve.

2.06 GEOTEXTILE FILTER FABRIC

A. Geotextile Fabric:

- 1. Nonwoven geotextile made up of polypropylene fibers with the following characteristics
 - a. Non-biodegradable and resistant to soil chemicals, acids, and alkali with a pH range of 3 to 12.
 - b. 6.0 oz/square yard weight per ASTM D5261
 - c. 160 grab tensile strength in accordance with ASTM D4632
 - d. 50% grab elongation per ASTM D4632
 - e. 60 lbs trapezoidal tear per ASTM D4533
 - f. CBR Puncture of 410 lbs per ASTM D6241
 - g. 1.5 second permittivity per ASTM D4491
 - h. 110 gpm/square foot water flow rate in accordance with ASTM D4491
 - i. 70% UV resistance @ 500 hours per ASTM D4355

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where foundation drainage systems are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.02 FOUNDATION DRAINAGE SYSTEM APPLICATIONS

A. Systems with 4-Inch Piping: As follows:

- 1. Perforated, polyvinyl chloride (PVC) sewer pipe and fittings for loose, bell-and-spigot joints.

3.03 SPECIAL PIPE-COUPLING APPLICATIONS

- A. Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

3.04 PIPING INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of foundation drainage system piping.
- B. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing, solidly in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Install piping pitched down in direction of flow, at a minimum slope of 1.5 percent.
 - 2. Provide recesses in excavation bottom to receive bells of pipe bell ends. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
 - 3. Apply and compact impervious fill material to raise low areas or where unsatisfactory bearing soil may occur.
- C. Use increases, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Maintain swab or drag in piping with tight joints and pull past each joint as it is completed.
- E. Extend piping and connect to site storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.05 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings as indicated and according to the following.
- B. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: With rubber compression gaskets according to CISPI "Cast Iron Soil Pipe and Fittings Handbook," Volume I. Use gaskets that match class of pipe and fittings.
- C. Polyvinyl Chloride (PVC) Pipe and Fittings: As follows:
 - 1. Join ASTM D 3034 sewer pipe and fittings with elastomeric seal gaskets according to ASTM D 2321.
 - 2. Join ASTM D 2729 perforated, sewer pipe and fittings with loose, bell-and-spigot joints.
 - 3. Install according to ASTM D 2321.
 - 4. Install perforated pipe with perforation down.

- D. System Piping Joints: Make joints using system manufacturer's seals and couplings, except where otherwise specified.
- E. Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.06 SLEEVE INSTALLATION

- A. Install sleeves in locations and at elevations indicated.

3.07 DRAINAGE CONDUIT INSTALLATION

- A. Install according to manufacturer's written instructions and as indicated. Coordinate placement with other foundation drainage materials.
 - 1. Comply with manufacturer's written instructions for securing drainage conduits to substrate. Use adhesives and mechanical fasteners recommended by manufacturer. Protect installed conduits during backfilling.
 - 2. Do not use drainage conduits as protection over waterproof membrane, unless otherwise approved by waterproofing-membrane manufacturer.

3.08 SOIL MATERIAL INSTALLATION

- A. Filter Fabric: Place filter fabric as detailed on drawings.
- B. Filtering Material: Place filtering material surrounding drainage pipe as detailed on the drawings.

3.09 FIELD QUALITY CONTROL

- A. Testing: Test drain piping with water or visually check piping to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
 - 1. Place additional filtering material to depth of 4 inches around sides and top of drains after testing.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Concrete building frame members.
- C. Concrete for composite floor construction.
- D. Floors and slabs on grade.
- E. Concrete reinforcement.
- F. Joint devices associated with concrete work.
- G. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 01 7419 - Construction Waste Management and Disposal
- B. Section 32 1313 - Concrete Paving
- C. Section 07 9005 - Joint Sealers: Sealants for saw cut joints and isolation joints in slabs.
- D. Section 07 1300 - Sheet Waterproofing

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.
- C. ACI 301 - Specifications for Concrete Construction 2020.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting 2020.
- G. ACI 306R - Guide to Cold Weather Concreting 2016.
- H. ACI 308R - Guide to External Curing of Concrete 2016.

- I. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).
- J. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).
- K. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- L. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- N. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.
- O. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- P. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.
- Q. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.
- R. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- S. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- T. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2020.
- U. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- V. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
- W. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
- X. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2022.
- Y. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

- Z. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- AA. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2021.
- BB. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- CC. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.
- DD. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) 2011 (Reapproved 2022).
- EE. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops 1974.
- FF. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop 1974.
- GG. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- D. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
- E. Samples: Submit samples of underslab vapor retarder to be used.
- F. Test Reports: Submit report for each test or series of tests specified.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

- I. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- J. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Retain list below with either paragraph above. Edit to suit Project.
 - 2. Cementitious materials and aggregates.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and reinforcement accessories.
 - 5. Admixtures.
 - 6. Waterstops.
 - 7. Curing materials.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Epoxy joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.
- K. Formwork Shop Drawings: Design and engineering of formwork are Contractor's responsibility.
 - 1. Delete subparagraph below if no shoring and reshoring are required.
 - 2. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- L. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

- M. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- N. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Total weight of products provided
 - 2. If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
 - 1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

- F. Testing Agency Qualifications: An independent testing agency as provided by the Contractor, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. Retesting if failed test to be provided and paid for by the General Contractor.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- G. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- H. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.07 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content. A minimum post-consumer recycled content of 30% is required for reinforcing steel.
- B. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Total weight of products provided
- 2. For products having Biologically Based Products, documentation indicating percentages of Biologically-Based Products.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance including:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
 2. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
 3. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 2. Form-Release agent to contain a minimum Biobased content of 87% per the USDA's standards
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).

1. Type: Deformed billet-steel bars.
2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
 1. Form: Coiled Rolls.
 2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - a. Provide solid concrete bricks to support bottom mats of spread footings and bottom bars in grade beams where rebar support will be in direct contact with soil. Concrete brick sizes as required to provide specified concrete cover.
 - b. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
 3. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement. Do not use admixtures containing calcium chloride.

- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- D. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- F. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Underslab on Grade Vapor Retarder

1. Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins, and when tested according to all requirements of ASTM E1745, shall meet the following minimum performance requirements:
 - a. Thickness: 15 mill
 - b. 0.0063 Perm, Water Vapor Permeance in accordance with ASTM E-96
 - c. Greater than 3200 Gram Puncture Resistance in accordance with ASTM D 1709 Method B
 - d. 72.61 (12.61) Lb. Force/Inch (kN/m) Tensile Strength per ASTM E 154 Section 9e. 0.0052 Perm Water Vapor Permeance After Wetting Out Drying Out and After Long-Term Soaking per ASTM E-154 Section 8 and ASTM E-96 Procedure B
 - e. 0.0057 Perm Water Vapor Permeance Resistance to Plastic Flow and Elevated Temperature per ASTM E-154 Section 11 and ASTM E-96 Procedure B
 - f. 0.0052 Perm Water Vapor Permeance Effect Low Temperature and Flexibility ASTM E-154, Section 12 ASTM E-96, Procedure B
 - g. 0.0052 Perm Water Vapor Permeance Resistance to Deterioration From Organisms and Substances in Contacting Soil ASTM E-154, Section 13 ASTM E-96 Procedure B
 - h. 8.7×10^{-9} Radon Transmittance (m/s) k124/02/95
 - i. 3.3×10^{-12} Radon Coefficient (m²/s)
2. Install per manufacturer's recommendations.
3. Tape all joints and waterproof seal all penetrations.

- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 - 1. Two-component epoxy resin, capable of humid curing and bonding to damp surfaces.
 - 2. Class and grade to suit requirements, and as follows:
 - a. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- C. Waterstops: Rubber, complying with COE CRD-C 513.
 - 1. Factory fabricate corners, intersections, and directional changes.
 - 2. Profile: Flat, dumbbell with center bulb.
- D. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
 - 1. Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick galvanized steel sheet.
- E. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
- F. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard, felt, or cork, complying with ASTM D 1751, 1/4 inch thick (6 mm thick) and 4 inches deep (200 mm deep); tongue and groove profile.
- G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- H. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

- I. Sealant and Primer: As specified in Section 07 9005.

2.07 CURING MATERIALS

- A. Moisture-Retaining Sheet: ASTM C171.

1. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).
2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).

- B. Evaporation Retarder:

1. Waterborne, monomolecular film forming retarder manufactured for application to fresh concrete.
2. Provide product meeting the recommendations of the following American Institute Publications:
 - a. ACI 302 Guide for Concrete Floor and Slab Construction
 - b. ACI 308 Guide to Curing Concrete
 - c. ACI 305 Recommended Practices for Hot Weather Concreting
 - d. ACI 345 Guide for Concrete highway Bridge and Deck Construction.

- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

- E. Curing Compound:

1. Water-based acrylic curing and sealing compound with the following characteristics:
 - a. AASHTO M148 Type 1, Class A and B
 - b. ASSTM C309 Type 1, Class A and B
 - c. Maximum VOC content of 20 g/L
 - d. Tested per CDPH/EHLB Standard Method V1.2-2017 Emission Testing Method

2. Install in accordance with manufacturer's recommendations and at a rate of +/- 200 square feet per gallon.

F. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
1. For trial mixtures method, employ qualified, independent testing agency acceptable to the Government for preparing and reporting proposed mix designs.
- C. Footings and Retaining Walls Piers: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 2. Maximum Slump: 4 inches (100 mm).
 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 3-inch (50- to 100-mm) slump.
- D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 psi (20.7 MPa) unless noted otherwise on the drawings.
 2. Maximum Slump: 4 inches (100 mm).
- E. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 20 percent.
- G. Maximum Water-Cementitious Materials Ratio: 0.53 for concrete with a 28 day compressive strength of $F'_c = 3000$ psi.

- H. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete with a 28 day compressive strength of $F'_c = 4000$ psi.
- I. Limit water - soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- J. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 4 to 6 percent, unless otherwise indicated.
- K. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.09 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.
- C. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 2. Use latex bonding agent only for non-load-bearing applications.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- E. Ensure vapor barrier is installed in accordance with project specifications prior to placing concrete. Refer to division 07.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor barrier. Repair damage and reseal vaporbarrier before placing concrete. Refer to division 07.
- B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

- C. Install welded wire reinforcement in maximum possible lengths on bar supports spaced to minimize sagging and offset end laps in both directions. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.
 - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.04 VAPOR RETARDERS

- A. Vapor Retarder: Refer to paragraph 2.05 of this section.
- B. Granular Fill: Cover compacted subgrade with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.05 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify the Government not less than 48 hours prior to commencement of placement operations.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.06 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- E. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Government.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs on grade.
 2. Form from preformed, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- F. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- G. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

- H. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

3.09 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by the Government.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 CONCRETE FINISHING

A. Finishing Formed Surfaces

1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
 - a. Apply to concrete surfaces of retaining walls to be covered with earth backfill.
2. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
 - a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - b. Do not apply rubbed finish to smooth-formed finish.
3. Rubbed Finish: Apply the following to smooth-formed finished concrete:
 - a. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
4. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

B. Finishing Floors and Slabs

1. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
2. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - a. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
3. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - a. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 - b. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - 1) Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
 - 2) For slab on grade areas receiving thin set tile, the overall minimum values of flatness shall be, F(F) 50 and the levelness, F(L) 35. Local values of flatness shall be, F(F) 35, and levelness, F(L) 20.
4. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

2. **Moisture-Retaining-Cover Curing:** Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
3. **Curing Compound:** Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

- A. **Penetrating Liquid Floor Treatment:** Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.15 FIELD QUALITY CONTROL

- A. **Testing Agency:** Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements: All retesting as a result of failed test to be provided by and paid for by the General Contractor.
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimens at 7 days and two at 28 days. Hold fourth specimen for future specimen for future testing if required. Discard if not required.
 - a. The contractor shall engage a qualified independent testing laboratory to make, field cure, and test standard cylinder specimens. The results of these tests shall be used by the contractor to evaluate field curing and for form removal.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

- E. Test results shall be reported in writing to the Government, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Government but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Government. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by the Government.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by the Government. Remove and replace concrete that cannot be repaired and patched to the Government's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Government.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to the Government's approval, using epoxy adhesive and patching mortar.

- F. Repair materials and installation not specified above may be used, subject to the Government's approval.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 05 5000 - Metal Fabrications: Loose steel lintels.
- C. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
- D. Section 07 6200 Sheet Metal Flashing and Trim
- E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.
- F. Section 07 6500 - Wall Flashing

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- F. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale) 2017.
- G. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2021.
- H. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2017.
- I. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2022.
- J. ASTM C91/C91M - Standard Specification for Masonry Cement 2023.
- K. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
- L. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2022c.
- M. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) 2022.
- O. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- Q. ASTM C476 - Standard Specification for Grout for Masonry 2022.
- R. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units 2021.
- S. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2020.
- T. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- U. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Maintenance Materials: Furnish the following for Government's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
- F. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided

1.06 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized and as indicated on drawings; include mortar and accessories, structural backup, wall openings, flashings, and wall insulation in mock-up, and other materials. Provide repurposed masonry samples as required and approved by the Government.
- B. Mock up may not remain as part of the work. Locate mockup adjacent to job trailer. Mockup will serve as the standard for expected quality of masonry work for the duration of the project.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - 1. Include statement indicating costs (sell price for each product having recycled content)
 - 2. Include total weight of products provided

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
 - 2. Special Shapes: Provide non-standard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - 4. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block.
 - 5. Bullnosed CMU: Provide radiused edge CMU at outside vertical corners.

2.02 BRICK UNITS

- A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Color and texture: Shall match exposed brick veneer of Building 30 in shape, size, texture, and color. Contractor to obtain Government's approval of brick selection prior to commencing order.
 - 2. Nominal size: As required to match existing brick veneer of Building 30.

3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- B. Grout Aggregate: ASTM C404.
- C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 1. Color(s): As required to match existing brick veneer mortar present at Building 30.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420) deformed billet bars; galvanized.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.
- D. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 3. Vertical adjustment: Not less than 3 inches (76 mm).

2.05 FLASHINGS

- A. Thru Wall Flashing - Refer to Division 07.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints. Field locate as required prior to installation. Control Joint spacing shall not exceed maximum spacing as indicated on structural drawings.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; maximum lengths available.
- C. Weeps:
 - 1. Polypropylene Weep:
 - a. Honeycomb design
 - b. Polypropylene material tested in accordance with ASTM D2240, D790B, D638, and D1238B
 - c. Size: 3/8" thickness x height and depth necessary to fill entire joint of masonry construction of which it is installed. Provide custom sizes if necessary.
- D. Mortar net: Fluid conducting non-absorbent Polyester mesh 16" x 96" x 3/4". Use multiple layers at bottom of wall and above through wall flashing when air space depth exceeds masonry mat thickness by 3/8".
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, as recommended by brick and mortar manufacturer.
- F. Where horizontal reinforcement is specified, provide prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
- G. Stainless Steel Termination Bar install continuous termination bar - refer to Section 07 6500.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, loadbearing masonry: Type S.
 - 3. Exterior, non-loadbearing masonry: Type S.
 - 4. Interior, loadbearing masonry: Type S.

- B. Colored Mortar: Proportion selected pigments and other ingredients to match Government's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 3. Mortar Joints: Concave.
- D. Brick Units:
1. Bond: Running.
 2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Provide top of wall weeps at 24" on center horizontally, above through-wall flashing, above shelf angles, lintels, and at bottom of walls. Locate as indicated on the drawings and at the top of all masonry veneer air space cavities as directed by the Government. Locate at consistent elevations within 8" of the top of the masonry cavities.

- C. Install cavity vents in veneer and cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar control panels continuously throughout exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch (9 mm) greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

3.08 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHER MASONRY

- A. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- B. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).
- D. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and end of panels, so maximum spacing of anchors is 8 inches on center.

3.10 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of openings.
- C. Lap joint reinforcement ends minimum 6 inches (150 mm).

- D. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 16 inches (400 mm) horizontally and 16 inches (400 mm) vertically.

3.11 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Refer to Division 7 for flashing requirements.

3.12 LINTELS

- A. Install loose steel lintels over openings of size required for loading if not specified otherwise.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

3.13 GROUTED COMPONENTS

- A. Reinforce bond beams with 2 scheduled bars. 1 inch (25 mm) from bottom web.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300mm) either side of opening.

3.14 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.15 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.

- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.17 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 FIELD QUALITY CONTROL

- A. The Contractor shall employ an independent testing agency to complete the following tests. Refer to section 01 4000 - Quality Requirements for additional requirements.
 - 1. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

2. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
3. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.19 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.20 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 3100 - STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof deck.
- B. Supplementary framing for openings up to and including 18 inches (450 mm).
- C. Bearing plates and angles.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.
- D. Section 04 2000 - Unit Masonry Assemblies: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- E. Section 05 4000 - Cold Formed Metal Framing.
- F. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- G. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).

- H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks 2007.
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- J. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).
- K. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Certificates: Certify that products furnished meet or exceed specified requirements.
- E. Submit manufacturer's installation instructions.
- F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- G. Sustainability Submittals:
 - 1. Submit documentation for harvesting and manufacturing locations of all steel decking intended for use on the project as may be required for proper documentation of LEED MR Credit 5.
 - 2. Provide documentation for pre and post-consumer recycled content for all steel decking intended for use as may be required for proper documentation of LEED MR Credit 4. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided

1.05 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints in accordance with manufacturers written recommendations in and for the the State in which the Project is located for project conditions.
- B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

1.07 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content.
 - 1. Minimum Post Consumer Recycled Content of 30% is Required.
 - 2. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.

PART 2 PRODUCTS

2.01 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
 - 2. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
- B. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
 - 2. Structural Properties:
 - a. See structural drawings.
 - 3. Minimum Metal Thickness, Excluding Finish: As noted on drawings.
 - 4. Nominal Height: 1-1/2 inch (38 mm).
 - 5. Profile: Fluted; SDI WR.

6. Side Joints: Lock seam or nested
7. End Joints: Lapped, welded.

2.02 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel unfinished.
- B. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.
- C. Welding Materials: AWS D1.1/D1.1M.
- D. Fasteners: Galvanized hardened steel, self tapping.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction, and applicable requirements of LEED EQ Credit 4.2 - Low Emitting Materials.
- F. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.

2.03 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage (0.8 mm) thick sheet steel for roof and 20 gage for floor; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.
- C. On steel supports provide minimum 2 inch bearing.
- D. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
 1. Welding: Use fusion welds through weld washers.
 2. Place and secure special deep fluted sections for integral concrete bridging.

- E. Clinch lock seam side laps, where applicable..
- F. At mechanically fastened male/female side laps fasten at 24 inches (600 mm) on center maximum.
- G. At welded male/female side laps weld at 18 inches (450 mm) on center maximum.
- H. Weld deck in accordance with AWS D1.3/D1.3M.
- I. At deck openings from 6 inches (150 mm) to 10 inches (254 mm) in size, provide 2 x 2 x 1/4 inch (50 x 50 x 6 mm) steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
 - 1. See structural drawings for openings larger than 10 inches.
- J. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
- K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
- L. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- M. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- N. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- O. Weld stud shear connectors through steel deck to structural members below.
- P. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

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SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel joist, purlin, and rafter framing and bridging as indicated on drawings.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Section 05 3100 - Steel Decking.
- D. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.
- E. Section 04 2000 - Unit Masonry
- F. Section 07 2500 - Weather Barriers: Weather barrier over sheathing.
- G. Section 07 9005 - Joint Sealers.
- H. Section 07 4213 - Ribbed Metal Wall Panel

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members 2012.
- B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- E. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud and ceiling joist and rafter layout.
 - 2. Describe method for securing studs to tracks and for bolted framing connections.
 - 3. Provide details and calculations for factory-made framing connectors.
- D. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content
 - a. Include statement indicating costs (sell price for each product having recycled content).
 - b. Include total weight of products provided.

1.06 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content.
 - 1. A minimum post-consumer recycled content of 30% is required.
 - 2. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Deliver to site in largest practical sections.
- C. Metal framing as required for exterior metal soffit system.

2.02 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Minimum stud depth and gage shall be indicated on structural drawings. All 16 gage and heavier studs shall be 50 ksi material.
- B. Framing Connectors: Factory-made, formed steel sheet.
 - 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
 - 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
 - 4. Rafters: Unpunched structural studs with properties indicated on drawings.

2.03 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, match stud thickness unless noted on drawings; finish to match framing components.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Welding: In conformance with AWS D1.1, when noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF JOISTS, PURLINS, and RAFTERS

- A. Install framing components in accordance with manufacturer's instructions and drawings.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- D. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- E. Section 05 5213 - RAILINGS & GUARDS.
- F. Section 06 2000 - Finish Carpentry
- G. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- H. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.

- I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- O. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- D. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content).
 - b. Include total weight of products provided.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.08 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content.
 - 1. A minimum post-consumer recycled content of 30% is required.
 - 2. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Fasteners:
 - 1. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and for both interior and exterior use where fastening into fire-retardant treated wood. Provide Zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, class, and substrate required.
 - 2. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 3. Anchor Bolts: ASTM F 1554, Grade 36.
 - 4. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
 - 5. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 - 6. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
 - 7. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
 - 8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - a. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).
 - 9. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

- H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

2.04 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.

- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions and surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

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SECTION 05 5213 - RAILINGS & GUARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel railings and guardrails.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 05-5000 - Metal Fabrications
- C. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- C. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).
- F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.04 SUBMITTALS

- A. Section 01 3001 - Submittals.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot (730 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails for Tube Railings:
 - a. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round, steel
 - 2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round, steel
 - a. Provide all accessories required for a complete installation including, but not limited to, connector sleeves, tees, and elbows.
 - 3. Posts for Tube Railings:
 - a. Permanent Posts:
 - 1) Posts: 1-1/2 inches (38 mm) diameter, round, steel
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

- D. Exposed Fasteners: No exposed bolts or screws.
- E. Straight Splice Connectors: Steel concealed spigots.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 - 1. Continuously seal joined pieces by continuous welds.
 - 2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Anchor railings securely to structure.
- D. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- E. Conceal anchor bolts and screws whenever possible.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Preservative treated wood materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 01 7419 - Construction Waste Management and Disposal
- D. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- E. Section 07 2500 - Weather Barriers: Air barrier over sheathing.
- F. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- E. AWP A U1 - Use Category System: User Specification for Treated Wood 2022.
- F. PS 20 - American Softwood Lumber Standard 2021.
- G. SPIB (GR) - Standard Grading Rules 2021.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Sustainability Submittals:
 - 1. For products having Biologically Based Products, documentation indicating percentages of Biologically-Based Products
 - 2. For products containing VOCs, documentation (material safety data sheets (MSDS), third-party certificates, or test reports) showing printed statement of VOC content.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high Biobased content where possible.
 - 1. See Part 2 of this specification section for specific biobased content thresholds, if applicable
- B. Contractor shall endeavor to provide materials with the lowest possible VOC content.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber products shall have a minimum Biobased content of 25% as defined by the USDA.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 1. Lumber: S4S, No. 2 or Standard Grade.
 2. Boards: Standard or No. 3.

2.03 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 2. Provide Type 304 or 316 stainless-steel fasteners for exterior use and for both interior and exterior use where fastening into fire-retardant treated wood.

2.04 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Fire Retardant Treatment:

1. Interior Type A: AWWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Preservative Pressure Treatment of Lumber Above Grade: AWWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing, flashing, or waterproofing.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Treat lumber less than 18 inches (450 mm) above grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Coordinate installation of rough carpentry members specified in other sections.
- C. Comply with all applicable codes for combustible material limitations.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.
- C. Provide preservative treated wood at all roof-related carpentry.

3.04 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 07 0100 - SPECIAL PROJECT ROOFING WARRANTY

PROJECT GENERAL CONTRACTOR'S ROOFING WARRANTY

NAME OF PROJECT: _____

LOCATION: _____

**GENERAL
CONTRACTOR:** _____

ADDRESS: _____

Date of Acceptance : _____ **Date of Expiration:** _____

- A. The Roofing, Metal Wall Panel, Contractor and General Contractor do hereby certify that the roofing, wall panel, and metal flashing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturers recommendations and provide warranties in accordance with Warranty Requirements per UFC 3-110-03 (Latest Edition) and as specified in individual specifications.
- B. The Roofing, Metal Wall Panel, Contractor and General Contractor do hereby guarantee the roofing, wall panels, and metal flashing and associated work including but not limited to all flashing; roof decking and/or sheathing; all material used as a roof substrate or insulation over which roof is applied; metal work; flashing to be absolutely water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of Beneficial Occupancy of the project. This guarantee does not extend to any deficiency which was caused by the failure of work which the general contractor or his assigns did not damage or did not accomplish or was not charged to accomplish.
- C. Subject to the terms and conditions listed below, the Roofing Contractor and General Contractor also guarantee that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: Blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashing etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within three (3) calendar days upon proper notification of leaks or defects by the Government.

1. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm with wind speeds above specified IBC code requirements, hailstorm and other unusual phenomena of the elements: and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the Roofing Contractor through the General Contractor, and until the cost and expense thereof has been paid by the Government or by the responsible party so designated.
2. During the Guarantee Period, if the Government allows alteration of the work by anyone other the Roofing Contractor through the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations, only for that specific are of the roof. If the Government engages the Roofing Contractor through the General Contractor to perform said alterations, the Guarantee shall not become null and void, unless the Roofing Contractor through the General Contractor, prior to proceeding with said work, shall have notified the Government in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.
3. Future building additions will not void this Guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.
4. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
5. The Government shall promptly notify the Roofing Contractor through the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Roofing Contractor and General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed this

_____ day of the year _____.

Roofing Contractor's Authorized
Signature

General Contractor's Authorized
Signature

Typed Name and Title

Typed Name and Title

END OF SECTION

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SECTION 07 1113 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS

- A. 04 2000 - Unit Masonry

1.03 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.
- B. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).
- C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).
- D. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- E. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
- F. NRCA ML104 - The NRCA Roofing and Waterproofing; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement;
 - 1. asbestos-free; suitable for application on vertical and horizontal surfaces.
 - a. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
 - b. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 APPLICATION

- A. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- C. Apply bitumen with roller and/or by spray application.
- D. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.
- E. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal (0.6 sq m/L) per coat.
- F. Seal items watertight with mastic, that project through dampproofing surface.

- G. Install in a minimum of 2 coats. Provide additional coats as required to ensure a continuous layer of damp proofing is installed and no pinholes are present.
- H. Coordinate with Contracting Officer Representative to review damp proofing prior to concealing. Repair pinholes as directed by manufacturer's written instructions.

END OF SECTION

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SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at cavity wall construction and where indicated on the drawings.
 - 1. Provide continuous board insulation on exterior side of concrete masonry walls of a minimum of three inches.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 01 7419 - Construction Waste Management and Disposal
- D. Section 04 2000 - Unit Masonry
- E. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022a.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.
- F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.

- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- D. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content
 - b. Included total weight of products provided
 - 2. For products having Biologically Based Products, documentation indicating percentages of Biologically-Based Products
 - 3. For products containing VOCs, documentation (material safety data sheets (MSDS), third-party certificates, or test reports) showing printed statement of VOC content.
 - 4. VOC Content Limitations: For the specified products, submit documentation of conformance with Specification Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content.
- B. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - 1. See Part 2 of this specification section for specific biobased content thresholds, if applicable.
- C. Contractor shall endeavor to provide materials with a high Biobased content where possible.
 - 1. See Part 2 of this specification section for specific biobased content thresholds, if applicable.

- D. Contractor shall endeavor to provide materials with the lowest possible VOC content.

PART 2 PRODUCTS

2.01 GENERAL CONDITIONS

2.02 APPLICATIONS

- A. Insulation Inside Exterior Masonry Cavity Walls Assemblies: Extruded polystyrene board.

2.03 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
1. Board Size as required to coordinate with specified masonry anchor spacings.
 2. Board Thickness: 3 inches (76 mm)
 3. Board Edges: Square.
 4. Board Density: 1.6 lb/cu ft (26 kg/cu m).
 5. Minimum compressive strength: 25 PSI, ASTM D1621
 6. Sustainability Requirements:
 - a. Minimum Biobased content per USDA: 7%
 - b. Minimum Recycled Content: Total Recovered Materials: 9%

2.04 ACCESSORIES

- A. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT CAVITY WALLS

- A. Apply adhesive to back of boards:

1. Full bed 1/8 inch (3 mm) thick.
- B. Install boards to fit snugly between wall ties, Z clips, and other components .
- C. Install boards horizontally on walls.
 1. Place boards to maximize adhesive contact.
 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 4213 - RIBBED METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ribbed-profile, exposed fastener metal wall panels, with related metal trim, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- D. Division 07 Section "Thermal Insulation" for thermal insulation installed behind metal panels.
- E. Division 07 Section "Bituminous Dampproofing" for Dampproofing within wall assembly and adjacent to wall assembly.
- F. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

1.03 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org
 - 1. AAMA 809.2 Voluntary Specification Non-Drying Sealants.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org <<http://www.astm.org>>:
 - 1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 3. ASTM C920 - Specification for Elastomeric Joint Sealants.

4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 8. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- D. International Accreditation Service (IAS):
1. IAS AC472 Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

1.04 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.
- B. Manufacturer Qualifications: Manufacturer with a minimum five years experience in manufacture of similar products in successful use in similar applications.
- C. Installer Qualifications: Experienced Installer with minimum of five years experience with successfully completed projects of a similar nature and scope.
 1. Installer's Field Supervisor: Experienced mechanic supervising work on site whenever work is underway.
- D. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.
 1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
 2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Contracting Officer, Contracting Officer Representative(s), Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.
 - 3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.06 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products. Include data indicating compliance with performance requirements.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
 - 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.
- E. Informational Submittals
 - 1. Product Test Reports: Indicating compliance of products with requirements.
 - 2. Qualification Information: For Installer firm and Installer's field supervisor.
 - 3. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.

4. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

F. Sustainability Submittals:

1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided

G. Closeout Submittals

1. Maintenance data.
2. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.
1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
 2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
 3. Shield foam insulated metal panels from direct sunlight until installation.

1.08 WARRANTY

- A. Provide warranty per the section 07 0100 Special Project Warranty by roofing and metal wall panel contractor and General Contractor.
- B. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within 15 years from date of Beneficial Occupancy.
- C. Special Weather tightness Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, without monetary limitation for 15 years from date of Beneficial Occupancy.

- D. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:
1. Fluoropolymer Two-Coat System:
 - a. Color fading in excess of 5 Hunter units per ASTM D2244.
 - b. Chalking in excess of No. 8 rating per ASTM D4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - d. Warranty Period: [25] years from date of Beneficial Occupancy.

1.09 MOCK -UP

- A. Include ribbed metal wall panels in project mock-up. Refer to drawing sheet A4.1 for wall mockup requirements.

1.10 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content:
1. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Recycled Content: For Steel Products: Minimum Total Recovered Materials Content - 30%
- C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:
1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of L/120 of the span with no evidence of failure.
- D. Wall Panel Air Infiltration, ASTM E283:
1. 0.002 cfm/sq. ft. air infiltration at static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
 2. 0.003 cfm/sq. ft. air infiltration at static-air-pressure difference of 12.00 lbf/sq. ft. (575 Pa).
- E. Wall Panel Water Penetration Static Pressure, ASTM E331: No uncontrolled water penetration at a static pressure of 20.00 lbf/sq. ft. (958 Pa).
- F. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.02 FORMED METAL WALL PANELS

- A. Ribbed-Profile, Concealed Fastener Metal Wall Panels: Structural metal panels consisting of formed metal sheet with fastener leg for concealed attachment to wall framing.
1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 pre-painted by the coil-coating process per ASTM A755/A755M.-
 - a. Nominal Thickness: 24 gauge coated thickness, with smooth surface.
 - 1) Exterior Finish: Fluoropolymer two-coat system
 - 2) Color: As required to match existing metal wall panels of Building 30. Provide custom color, if required. Submit samples to Contracting Officer Representative for approval.
 2. Panel Width: 16 inches (406 mm).
 3. Panel Thickness: 7/8 inch (22 mm).

2.03 MISCELLANEOUS MATERIALS & ACCESSORIES

- A. General: Provide complete metal panel assemblies incorporating trim, copings, fascia, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

- B. Sub-framing Z-girts: See specification section 07 4800 - Continuous Insulation Channels
- C. Flashing and Trim: Match material, thickness, and finish of metal panels.
- D. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.
- E. Panel Sealants:
 - 1. VOC Content of Interior Sealants: Sealants used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - 2. Concealed Joint Sealant: Non-curing butyl, AAMA 809.2.
 - 3. Elastomeric Joint Sealant: Urethane sealant, single-component, ASTM C920 Type S, Grade NS, Class 25, Use NT, A, M, G, O.
 - 4. Tape Mastic: Manufacturer's standard butyl type.

2.04 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.05 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 2605, meeting solar reflectance index requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.02 METAL PANEL INSTALLATION

- A. Concealed-Fastener Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading flange. Snap-fit back flange of subsequent panel into secured flange of previous panel.
 - 1. Cut panels in field where required using manufacturer's recommended methods.
 - 2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.
- D. Joint Sealers: Install liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.
 - 1. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
 - 2. Seal perimeter joints between window and door openings and adjacent panels using elastomeric joint sealer.

3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.03 ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.04 FIELD QUALITY CONTROL

- A. Roofing/Wall Consulting Services:
 1. The Contractor will engage the services of a Professional Roof Consultant. The Consultant must be listed as a Professional Member of the Roof Consultants Institute (RCI, Inc.) The Consultant shall attend the pre-roofing/wall meeting and perform no less than three (3) inspections during the installation of the new metal wall panel system(s) (1-start up inspection, 2 –Interim inspection, 3 – Final inspection). The consultant must document all site visits with photographs and written reports. All reports shall be forwarded to the Government with documentation of the job progress and any deficiencies noted during the inspections. Upon completion of all punch list items, the Roof Consultant shall provide a letter of certification to the Government stating the new wall/roof system has been installed per the requirements of the contract documents, manufacturer's requirements, and all warranty requirements.

3.05 CLEANING AND PROTECTION

- A. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Government.

END OF SECTION

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SECTION 07 4800 - CONTINUOUS INSULATION CHANNELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Continuous insulation furring channels for the installation of ribbed metal wall panels.

1.02 RELATED REQUIREMENTS

- A. Related Sections:

1. Section 01 3001 – Submittals
2. Section 07 2100 – Thermal Insulation
3. Section 07 7113 - Bituminous Dampproofing
4. Section 07 4213 – Ribbed Metal Wall Panels
5. Section 07 6500 – Sheet metal flashing and Trim

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:

1. Manufacturer is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
2. Employ registered professional engineer, licensed to practice engineering in jurisdiction where Project is located, to engineer each component of rainscreen attachment system.
3. Structural Design: Exterior-insulated rainscreen wall assembly capable of withstanding effects of load and stresses from dead loads, wind loads, ice loads (if applicable) as indicated on Structural General Notes on Structural Drawings, and normal thermal movement without evidence of permanent defects of assemblies or components.
 - a. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum ambient temperatures by preventing overstressing of components and other detrimental effects:
 - 1) Temperature Change (range): 120 degrees Fahrenheit (67 degrees C), ambient:
4. Support Framing/Attachment System:

- a. No framing component may penetrate the layer of continuous exterior insulation other than thermally isolated fasteners.
- b. Frequency and spacing of stiffened horizontal girts as indicated by manufacturer in project specific engineering package.

B. Performance Requirements:

- 1. Rainscreen Attachment System Performance: Comply with ANSI/ASHRAE 90.1-2010 definition of continuous insulation (c.i.).
- 2. No thermal bridges other than fasteners and service openings.
- 3. Thermal Performance:
 - a. Full constructed assembly must have a minimum 95% EFFECTIVE R-value when compared to the exterior continuous insulations rated R-Value.
 - b. Continuous framing profiles (including C- or Z-shaped sections or furring) penetrating insulation not allowed.
 - c. Perform effective R-Value calculation or modeling in accordance with ASHRAE guidelines.
 - d. Wall Assembly effective R-Value: Refer to specification section 07 2100 – Thermal Insulation
- 4. Structural Performance:
 - a. Wind Load Performance – Attachment system must show the following results when tested in accordance with ASTM E330-02.
 - 1) 90 pound per square foot negative and positive pressure held for 60 seconds, system components shall not experience failure or gross permanent distortion.
 - 2) 135 pound per square foot negative and positive pressure held for 10 seconds, system components shall not experience failure or gross permanent distortion.
 - b. Wind cycling (air pressure cycling) performance – Attachment system must show conformance to the following results when tested in accordance with ASTM E1886-05.

- 1) A total of 4,500 air pressure cycles. Cycles must include 50 cycles at a maximum pressure of 90 pounds both positive and negative. Average cycle time must not be less than 3.25 seconds for both negative and positive cycles. Cladding weight supported during test must be a minimum of 11.5 pounds per square foot. No damage or deformation must be seen at end of test.
- c. Gravity load (dead load) performance – Attachment system must demonstrate resistance to deflection under shear loading, applied parallel to the wall assembly and directly to the attachment system. Testing must be conducted using calibrated equipment by an IAS accredited third party laboratory. Deflection not to exceed 0.050 inches at 150 pounds per square foot.
5. Framing Members:
 - a. Test framing components to AAMA TIR- A8-[04] – Section 7.2 to determine structural performance and effective moment of inertia for each perforated component. Minimum Effective Moment of Inertia: 0.0066 in⁴.
 - b. Localized bending stress for eccentrically loaded framing members must be evaluated with the maximum effective length of resisting element not more than 12 inches.
6. Fasteners:
 - a. Minimum Safety Factor of 3 for both tension and shear values
 - b. Combined tension and shear shall be evaluated according to an interaction formula. Sum of terms shall not exceed 1.0.

1.04 SUBMITTALS

- A. See Section 01 3001 – Submittals, for submittal procedures
- B. Product Data: Submit manufacturer's product literature and descriptions of testing performed on system components to indicate meeting or exceeding specified performance.
- C. Shop Drawings:
 1. Submit connection details to the cladding manufacturer, showing interface of rainscreen attachment system to substrate and panels with adjacent construction, signed and sealed by Professional Engineer licensed to practice in Alabama.
 2. Show system installation and attachment, including fastener size and spacing.

D. Structural Calculations:

1. Submit rainscreen attachment manufacturer's comprehensive Structural Design analysis signed and sealed by a Professional Engineer.

E. Samples: Submit following material samples for verification:

1. Vertical Girts: Two (2) 12-inch long samples.

F. Test Reports:

1. Test to the following standards and provide written test reports by a third party:
 - a. AAMA TIR-A8-[04]: Structural Performance of Composite Thermal Barrier Framing Systems – Section 7.2
 - b. ASTM E330
 - c. ASTM E1233
 - d. Gravity load test report, performed by IAS accredited third party
2. Comprehensive three-dimensional thermal modeling report indicating framing systems impact on exterior insulation rated R-value.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum 5 years' experience specializing in the manufacturing of façade attachment/support framing similar to those specified.
2. Ability to demonstrate conformance to testing requirements.

B. Installer Qualifications:

1. Minimum of 3 years documented experience or minimum of 5 completed projects of equivalent scope and quality and recommended by manufacturer to perform work of this Section.

C. Engineer Qualifications: Registered professional engineer experienced in the design of curtain wall systems, anchors, fasteners and licensed to practice engineering in the jurisdiction where Project is located.

1.06 QUALITY CONTROL

A. Single source responsibility:

1. Furnish engineered rainscreen attachment system components under direct responsibility of single manufacturer.
- B. Field Measurements: Verify actual supporting and adjoining construction before fabrication.
- C. Record field measurements on project record shop drawings.
- D. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rainscreen attachment system corresponding to established dimensions.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials and components in manufacturers' original, unopened and undamaged containers or bundles, fully identified. Exercise care to avoid damage during unloading, storing and installation.
- B. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter, and protect from damage due to weather or construction activities.

1.08 SEQUENCING

- A. Ordering: Comply with manufacturers' ordering instructions and lead time requirements to avoid construction delays.
- B. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying work.

1.09 WARRANTY

- A. Manufacturer Warranties:
 1. Attachment System: Ten (10) year Limited Warranty.
 - a. Covers components of the attachment system, including structural failure of components when all the materials and components are supplied and installed per manufacturer's requirements.
 - b. Includes labor and material for removal and replacement of defective material.
 - c. Includes labor to remove and reinstall façade finish panels, finish closures and façade finish accessories necessary to access defective material.

- B. Contractor's Warranties: 2-year labor warranty, starting from Beneficial Occupancy to cover repair of materials found to be defective as a result of installation errors.

PART 2 - PRODUCTS

2.01 RIGID INSULATION

- A. Refer to Section 07 2100 – Thermal Insulation.

2.02 RAINSCREEN ATTACHMENT/SUPPORT FRAMING SYSTEM

- A. Comply with ANSI/ASHRAE 90.1-2010 definition of continuous insulation (c.i.).
- B. Coating Material: ASTM A1046, Zinc-Aluminum-Magnesium, minimum thickness ZM40.
 - 1. ASTM A653 Galvanized steel is not acceptable.
- C. Steel Classification: Structural Steel (SS), Grade 50, 50 ksi Yield.
- D. Spacing: Comply with manufacturer's Professional Engineers calculations.
- E. Vertical Girt: Vertical girt with pre-punched attachment holes, directly attached on top of rigid insulation directly to substrate at regular spacing, with engineered thermally isolated washer assembly and fasteners.
 - 1. Steel Thickness: Minimum 0.046-inch thick (18 gauge).
 - 2. Profile Depth:
 - a. 1.50 inches for installation of ribbed metal wall panels
 - 3. Girt Fastening Face, Width: 2-inches.
- F. Fasteners:
 - 1. Sufficient length to provide solid attachment through rigid insulation to structure as required by manufacturer.
 - 2. Thermal Isolating Washers: Minimum 0.125 inch thick Polyoxymethylene copolymer (POM) washers with integral centering lip to act as a thermal break between wall anchor fasteners and girt.
 - a. Tensile Yield Strength: 9.57 ksi per ISO 527
 - b. Melting Temperature: 329 degrees Fahrenheit per ISO 3146
 - 3. Steel stud framing substrate: Self-drill hex-washer-head stainless steel with 1,000 hour salt-spray rated thermoset polyester coating.

- a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
 - b. Minimum ultimate pull-out capacity from 18 gauge steel: 450 pounds.
- G. Accessories:
- 1. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

2.03 SIDING/CLADDING PANEL

- A. Refer to Division 07 Section 07 4213 – Ribbed Metal Wall Panels.

PART EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with manufacturer requirements for installation conditions affecting performance of the work.
 - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 2. Ensure Bituminous Dampproofing and rigid insulation is installed prior to installing rainscreen attachment system.
 - 3. Ensure fenestration, transitions, discontinuities, sills, and ledgers are flashed and sealed to move moisture to the exterior of the building.
- B. Field verify architectural details and mechanical and electrical requirements prior to commencing installation.
- C. Commencement of installation constitutes acceptance of existing conditions and acceptance of responsibility for satisfactory performance.

3.02 RAINSCREEN ATTACHMENT SYSTEM INSTALLATION

- A. Preparation:
 - 1. Verify vertical girt does not cantilever past rigid insulation.
- B. Installation
 - 1. Install vertical girts in vertical orientation in strict accordance with manufacturer's installation instructions.
 - 2. Do not use shims to plumb the wall between the vertical girt and insulation.

3. Minimum length of installed cut girt is 24-inches and shall be attached with at least two (2) fasteners.
4. Mount box girts, fastened up to 32 inches on center (as determined by the manufactures engineering calculations) over installed rigid insulation, using one wall anchor per pre-punched attachment hole at spacing indicated on engineering calculations.
 - a. Check plumb of vertical girts both parallel and perpendicular to the structure.
 - b. Tighten screws that attach vertical girt through insulation to substructure to a snug tight condition and not stripped. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes.
 - c. Where obstructions are present and unavoidable (i.e. window openings), use laser or chalk line to restart girt.
 - d. Locate vertical girt at jamb conditions and outside corner conditions.
 - e. Use shearing instruments (i.e. snips, nibbler, etc.) for cutting metal framing components. Saws are not recommended, as the sparks produced during cutting will damage the anti-corrosion coating. If sparks are generated during cutting, be sure the portion of the component to be installed on the building is protected from sparks and that any stockpile near the cutting station is also protected.
 - f. The systems components should not be cut while installed on the building, unless using a shearing instrument.
 - g. Replace thermal isolator pieces that break during installation.
 - h. Provide a 3/8" – 1/2" gap between girts for expansion when multiple lengths of vertical girts are installed.

3.03 SIDING/CLADDING PANEL INSTALLATION – REFER TO SECTIONS 07 4213

- A. The cavity must be clear and free from air flow and drainage obstructions.

END OF SECTION

SECTION 07 5400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered
- C. Deck sheathing
- D. Flashings
- E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED SECTIONS

- A. Section 01 6000 - Product Requirements
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Section 05 3100 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.
- D. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
- E. Section 07 6200 - Sheet Metal Flashing and Trim.
- F. Section 07 7100 - Roof Specialties

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
- D. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2015.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

- F. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.
- G. FM DS 1-28 - Wind Design; 2007.
- H. NRCA (RM) - The NRCA Roofing Manual; 2017.
- I. NRCA (WM) - The NRCA Waterproofing Manual; 2005.
- J. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- K. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a conference 10 days before starting work of this section.
 - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, fasteners, and manufacturers approved adhering materials.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- D. Samples for Verification: Submit two samples 12 inches by 12 inches in size illustrating insulation, colored coating, and an actual sample of membrane.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- H. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.

- a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided
- I. Warranty:
1. Submit manufacturer warranty and ensure that forms have been completed in the Government's name and registered with manufacturer.
 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section:
1. With minimum five years documented experience.
 2. Provide written approved by membrane manufacturer prior to commencing with work.
- C. PREINSTALLATION MEETING: The General Contractor shall schedule a preinstallation meeting with all subcontractors involved with roof and associated trades, including the Contracting Officer, Contracting Officer Representative(s), the architect, the roofing consultant, and the manufacturers technical representative. The contractor shall be responsible for coordinating and holding a pre-installation conference. The required attendees shall be the Contractor, all related sub-contractors, the waterproofing subcontractor, project manager, and superintendent, and the waterproofing manufacturer's representative, the Contracting Officer, Contracting Officer Representative(s), and Architect. Topics to be discussed include, but are not limited to delivery dates, specialty contractor skill sets and capabilities, work schedules, and approved submittals.

- D. Roof Manufacturer's Field Technical Representative shall be present for the Roofing Pre-Installation Conference and shall perform routine site visits to observe roofing system installation. Each site visit will be followed by a written report from the Representative within 5 working days issued to the Roofing Subcontractor and be promptly forwarded to the GC for distribution to Team Members. Technical Representative shall perform final roof inspection followed with a written report for distribution to Team Members, Roofing Sub-contractor shall provide a minimum of five working days notice to Team Members through the GC of final roof inspection date to allow others to attend.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, clear of ground and moisture.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Project roofing warranty attached at the end of this section, signed by the General Contractor. Present this warranty at the inspection for Beneficial Occupancy.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years no dollar limit
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Exceptions NOT Permitted:
 - a. Damage due to roof traffic.

- b. Damage due to wind of speed greater than 72 mph (115 km/h) but less than 90 mph (145 km/h).
- D. Provide all executed warranties at the inspection for Beneficial Occupancy.
- E. Warranty shall be governed by the laws of the State of Alabama.

1.10 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content:
 - 1. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

PART 2 - PRODUCTS

2.01 ROOFING - UNBALLASTED APPLICATIONS

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.
- B. Roofing Assembly Requirements:
 - 1. Roof Covering External Fire Resistance Classification: UL Class A.
 - 2. Factory Mutual Classification: Class I and windstorm resistance of I-90, in accordance with FM DS 1-28.
- C. Acceptable Insulation Types - Tapered Application: Polyisocyanurate
 - 1. Tapered polyisocyanurate board covered with uniform thickness glass fiber board. Refer to drawings for locations. Minimum slope at 1/4" per linear foot, minimum thickness as required to align new roof assembly with existing roof eave elevation and increasing to thickness required for the minimum slope.
- D. Recycled Content: Minimum of 10% Total Recovered Materials Content

2.02 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane
 - 1. Material: Polyvinyl chloride complying with ASTM D4434/D4434M.
 - 2. Reinforcing: Internal fabric.
 - 3. Thickness: 80 MIL Thickness
 - 4. Sheet Width: Factory fabricated into largest sheets possible.

5. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
 6. Thermal Emissivity: 0.80, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
 7. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
- D. Flexible Flashing Material: Same material as membrane.
- E. Flashings Membrane:
1. Shall be .060 inch (1.52 mm)-thick unsupported membrane for field-fabricated details used for making field flashings that require higher extensibility than is allowed with scrim-reinforced membrane. Typical application examples include inside and outside corners, vent stacks, and other penetrations.

2.03 DECK SHEATHING AND COVER BOARDS or RECOVERY BOARD

- A. Deck Sheathing and Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (6 mm) thick at roof and 1/2 inch vertical applications.

2.04 INSULATION

- A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 2, polymer bonded glass fiber mat both faces and with the following characteristics:
1. Tapered Board: Slope as indicated; minimum thickness of 1-1/2 inch; fabricate of fewest layers possible.
 2. Board Edges: Square.

2.05 ACCESSORIES

- A. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- B. Membrane Adhesive: As recommended by membrane manufacturer.

- C. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- D. Insulation Adhesive: As recommended by insulation manufacturer.
- E. Sealants: As recommended by membrane manufacturer.
- F. Provide ES-1 wind rated manufacturers metal transition systems with welded miters; where required.
 - 1. Refer to section 07 7100 - Roof Specialties

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 METAL DECK PREPARATION

- A. Inspect metal deck prior to installation.
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
 - 3. Tape joints.
 - 4. Mechanically fasten the first layer of the insulation board to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.04 INSULATION - UNDER MEMBRANE

- A. Attachment of Insulation: Mechanically attach per 3.03 - First Layer
- B. Attachment of Insulation: Embed layers of subsequent insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions and drawings.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

3.05 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate required to meet uplift requirements. Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (75 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge where required by membrane manufacturer.
- E. At intersections with vertical surfaces:

1. Install in accordance with NRCA Detail as approved by the Government and manufacturer.
- F. Allow 12-inch minimum spacing between roof penetrations, curbs and perimeter walls to allow the use of Manufacturer's preformed and/or flexible flashings for Warrantied Detail.
- G. Around roof penetrations, seal flanges and flashings with flexible flashing. Pitch pockets are NOT allowed on this project.
- H. Install roofing expansion joints where indicated. Make joints watertight.
- I. Coordinate installation of roof drains and sumps and related flashings.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.
- C. Roofing Consulting Services:
 1. The Contractor will engage the services of a Professional Roof Consultant. The Consultant must be listed as a Professional Member of the Roof Consultants Institute (RCI, Inc.). The Consultant shall attend the pre-roofing/wall meeting and perform no less than three (3) inspections during the installation of the new metal wall panel system(s) (1-start up inspection, 2 –Interim inspection, 3 – Final inspection). The consultant must document all site visits with photographs and written reports. All reports shall be forwarded to the Government with documentation of the job progress and any deficiencies noted during the inspections. The Contractor will be required to make any and all repairs to deficiencies noted by the roofing consultant at no additional cost to the Government. Upon completion of all punch list items, the Roof Consultant shall provide a letter of certification to the Government stating the new wall/roof system has been installed per the requirements of the contract documents, manufacturer's requirements, and all warranty requirements.
- D. Manufacturer's Technical Representative

1. The representative shall have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative shall be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative shall be available to preform field inspections and attend meetings as required herein, and as requested by the Government.

E. Manufacturer's Field Inspections

1. Manufacturer's technical representative shall visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative shall perform a field inspection during the first 20 square of roof panel installation and at Beneficial Occupancy prior to issuance of warranty, as a minimum, and as otherwise requested by the Government. Additional inspections shall not exceed one for 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors shall be performed as requested by the Government. Each inspection visit shall include a review of the entire installation to date. After each inspection, a report, signed by the manufacturer's technical representative, shall be submitted to the Government noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify the Government a minimum of 3 workings days prior to site visit by manufacturer's technical representative.

3.07 INSPECTION

- A. Destructive tests shall be performed daily on a 3 inches (76 mm) wide area of seam weld to verify sufficient peel strength. Verify seam strength and correct procedures and seams that do not provide watertight durable construction.
1. Destructive tests shall be dated, initialed by Field Super and stored at GC's Field Office in a container for Team Members' viewing. The GC shall store destructive test samples with project archives.
 2. A properly welded seam will have membrane delamination from scrim prior to weld failure.
 3. Additional destructive tests on welds shall be conducted for the first seam of the day, the first seam after the robot welder has been allowed to cool down, and after any extreme changes in weather conditions.

4. Upon completion of the installation, an inspection will be performed by a representative of the roofing manufacturer to ascertain that the roofing membrane system has been installed according to approved specifications and details. Upon approval of the project, a Warranty shall be written.
5. Roof Manufacturer's Field Technical Representative shall be present for the Roofing Pre-Installation Conference and shall perform routine site visits to observe roofing system installations. Each site visit will be followed by a written report from the Representative within 5 working days issued to the Roofing Subcontractor and be promptly forwarded to the GC for distribution to Team Members.
6. Roof Manufacturer's Technical Representative shall perform final Roof Inspection followed with a written report for distribution to Team Members. Roofing Subcontractor shall provide a minimum of five working days notice to Team Members through the GC of final roof Inspection date to allow others to attend.

3.08 CLEANING

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION

- A. Protect installed products until completion of project.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.
- C. Touch-up, repair or replace damaged products before Beneficial Occupancy.

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**PROJECT ROOFING WARRANTY FOR THERMOPLASTIC MEMBRANE ROOFING -
SPECIFICATION SECTION 07 5400 AND RELATED SECTIONS AND ASSOCIATED
WORK**

NAME OF PROJECT:			
LOCATION:			
GENERAL CONTRACTOR:			
ADDRESS:			
DATE OF ACCEPTANCE:		DATE OF EXPIRATION:	

- D. The General Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturer recommendations and as governed by the state of Alabama.
- E. The General Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal; roof decking and/or sheathing; all material used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of Beneficial Occupancy of the project. This guarantee does not extend to any deficiency which was caused by the failure of work which the general contractor did not damage or did not accomplish or was not charged to accomplish.

- F. Subject to the terms and conditions listed below, the General Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work, in accordance with the roofing manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: Blisters, delamination, ridges, wrinkles, splits, warped insulation and/or loose flashing etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within three (3) calendar days upon proper notification of leaks or defects by the Government.
1. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the General Contractor, and until the cost and expense thereof has been paid by the Government or by the responsible party so designated.
- G. During the Guarantee Period, if the Government allows alteration of the work by anyone other than the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the Government engages the General Contractor to perform said alterations, the Guarantee shall not become null and void, unless the General Contractor, prior to proceeding with said work, shall have notified the Government in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.
- H. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
- I. The Government shall promptly notify the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, THIS INSTRUMENT HAS BEEN DULY EXECUTED

THIS ____ DAY OF ____ (YEAR).

GENERAL CONTRACTOR'S AUTHORIZED SIGNATURE

TYPED NAME AND TITLE

NOTARY PUBLIC

END OF SECTION

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SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, other applications indicated on the drawings, and exterior penetrations and other items as required.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. section 01 7419 - Construction Waste Management and Disposal
- C. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
- D. Section 07 4213 - Ribbed Metal Wall Panel
- E. Section 07 54000- Thermoplastic Membrane Roof - PVC Kee
- F. Section 07 7100 - Roof Specialties.
- G. Section 07 9000 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- C. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007 (Reapproved 2018).
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- E. CDA A4050 - Copper in Architecture - Handbook current edition.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for Submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples in size illustrating metal finish color.
- D. Submit details and mock-ups certified by manufacturer of outside and inside corner wall Flashing conditions.
- E. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.
- D. Provide written verification that low slope roof flashing meets or exceeds ES-1. Increase thickness of flashings as required to obtain ES-1.

1.07 MOCK UP

- A. Refer to 01 4000 - Provide installed roof sample on mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.09 PRE-ROOFING MEETING:

- A. Organize and conduct a meeting at the construction site 2 weeks before scheduled start of roof system installation with roofing installer; installer of each component of related work, including deck or substrate construction, roof equipment, penetrations of roof deck, and other work integral with or adjacent to roofing; the architect; the Contracting Officer; the Contracting Officer Representative(s), roofing manufacturer's representative; the roofing consultant; roofing contractor; and other parties involved with roofing system performance, independent testing agencies, and governing authorities.
 - 1. Walk roof areas to review and discuss substrate preparation including repair of unacceptable surfaces, roof drainage, penetrations, equipment curbs, and work performed by other trades which requires coordination with roofing system.
 - 2. Examine steel deck for proper flatness and slope, review structural capability for supporting roofing system and methods of fastening.
 - 3. Review contract document requirements and submittals for roofing system, including roofing schedule, inspection and testing, and environmental conditions. Identify what are considered unacceptable weather conditions for roofing, and which governing regulations or insurance requirements will affect roofing system installation.
 - 4. Document discussions in writing, including actions required, and distribute copy of reports to each meeting participant.

1.10 WARRANTIES:

- A. Flashing warranty: Provide flashing warranty, agreeing to correct defects of materials.
 - 1. Duration: Five (20) years from the date of completion.
- B. Manufacturer's finish warranty:
 - 1. Covering bare metal against rupture, structural failure and perforation due to normal atmospheric corrosion exposure.
 - 2. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading.
 - 3. Duration: twenty (20) years

1.11 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content:

1. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage thick base metal, shop pre-coated with PVDF coating.
 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system. Provide manufacturer's standard prime coat on underside.
 2. Color: Prior to ordering sheet metal, contractor to receive in color selection approval in writing by Government & Owner from manufacturer's full colors.
- B. Bond Membrane: Do not allow dissimilar metals to contact. Provide a manufacturer approved bond membrane between dissimilar metals.
- C. Provide sheet metal in increased gage/thickness where required for cleats and as needed to meet applicable wind loading/ES-1 ratings.
- D. Recycled Content, for steel products: Minimum Total Recovered Materials Content - 30%

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Underlayment: Self Adhered Underlayment Equal to Grace Ultra (high Temperature).
- C. Primer: As recommended by manufacturer for application and specified finish.
- D. Protective Backing Paint: Asphaltic mastic, ASTM D 4479 Type I.
- E. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- F. Sealant to be Exposed in Completed Work: {rs\#1}; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- G. Sealant: Type II specified in Section 07 9005 - Joint Sealants.
- H. Plastic Cement: Type I.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 1 inches (25 mm) wide, interlocking with sheet. Provide continuous cleats where indicated on drawings and/or recommended by SMACNA.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).
- C. Protect against galvanic action between dissimilar metal contact surfaces as recommended by metal manufacturers.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

- B. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- C. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.
- C. Roofing Consulting Services:
 - 1. The Contractor will engage the services of a Professional Roof Consultant. The Consultant must be listed as a Professional Member of the Roof Consultants Institute (RCI, Inc.). The Consultant shall attend the pre-roofing/wall meeting and perform no less than three (3) inspections during the installation of the new metal wall panel system(s) (1-start up inspection, 2 –Interim inspection, 3 – Final inspection). The consultant must document all site visits with photographs and written reports. All reports shall be forwarded to the Government with documentation of the job progress and any deficiencies noted during the inspections. The Contractor will be required to make any and all repairs to deficiencies noted by the roofing consultant at no additional cost to the Government. Upon completion of all punch list items, the Roof Consultant shall provide a letter of certification to the Government stating the new wall/roof system has been installed per the requirements of the contract documents, manufacturer's requirements, and all warranty requirements.

END OF SECTION

SECTION 07 6500 - WALL FLASHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and Division 01 Specifications Sections, apply to this Section.
- B. Section 04 2000 – Unit Masonry
- C. Section 07 7113 - Bituminous Dampproofing
- D. Section 07 6000 – Sheet Metal Flashing and Trim

1.02 SUMMARY

- A. Section provides for a flexible rubberized asphalt, self –sealing through-wall flashing and wall flashing, and stainless steel 26 gauge terminations at all dissimilar masonry transitions and general horizontal masonry drainage.
- B. In no case shall wall flashing be exposed to sun light. If drawings show the flashing exposed disregard. Wall flashing is not to be exposed to sun light.

1.03 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM E 96 – Test Methods for Water Vapor Transmission of Materials.
 - 2. ASTM D 570 – Test method for Water Absorption of Plastics.
 - 3. ASTM E 154 – Test Method for Water Vapor Retarders used in contract with Earth Under Concrete Slabs, on Walls or as Ground Cover.
 - 4. ASTM D 1004 – Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 5. ASTM D 1938 – Test Method for Tear Propagations Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
 - 6. ASTM D 1876 - Test Method for Peel Resistance of Adhesives.
 - 7. ASTM D 1970 – Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

8. ASTM D 412 – Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.

1.04 SUBMITTALS

- A. Product Data and Shop Drawings: Submit for each product; Spec-Data®/Data Sheets, details and installation procedures.
- B. Test Reports: Indicating compliance with the performance requirements of this section.
- C. Samples of flashing.
- D. Mock-up: Refer to section 04 2000 Unit Masonry.
- E. Pre-installation meeting with Architect, Contracting Officer, Contracting Officer Representative(s), Contractor's Construction Manager, Window or Storefront Supplier, Masonry Contractor, Flashing Manufacturer, Waterproofing Subcontractor and others associated with the work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's recommendations for storage and handling of each product.

1.06 WARRANTY

- A. Standard Product Warranty:
 1. Submit manufacturer's 5-year warranty at the end of this section, signed by the authorized General Contractor and the authorized Waterproofing Subcontractor. Date of the warranty shall be established as the Beneficial Occupancy Date.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Through Wall Flashing as referred to on drawings: 40 mil total thickness, self-adhered flexible flashing installed in conjunction with stainless steel drip plate, terminate bar, and sealant. Provide mastic, adhesive, primers, seam tapes per manufacturers' instructions and specified warranties.
- B. Performance Requirements:
 1. Water Vapor Transmission: ASTM E 96, Method B-2.9 ng/m²sPa (0.05 perms) maximum.
 2. Water Absorption: ASTM D 570 – Max 0.1% by weight.

3. Puncture Resistance: ASTM E 154 – 178 N (40 lbs.)
 4. Tear Resistance:
 - a. Initiation – ASTM D 1004 – min. 58 N (13.0 lbs) M.D.
 - b. Propagation – ASTM D 1938 – min. 40 N (9.0 lbs) M.D.
 5. Lap Adhesion at -4°C (25°F): ASTM D 1876 – 880 N/M (5.0 lbs./in.) of width
 6. Low Temperature Flexibility: ASTM D 1970 – Unaffected to -43°C (-45°F).
 - a. Tensile Strength: ASTM D 412, Die C Modified – Min. 5.5 MPa (800 psi)
 7. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D 412, Die C – Min. 200%.
 8. ASTM C-836
 9. ASTM E-2357
 10. ASTM 330
- C. Sealant for Termination Bar:
1. Provide manufacturer's recommended sealant to ensure compatibility with damproofing product specified and being provided.
- D. Outside and inside corners - per manufacturer.
- E. Flashing Weeps – Mortar Nets, etc. Refer to Section 04 2000 “Unit Masonry” for additional installation requirements.
- F. Termination Bar, thru wall flashing at weeps, misc flashings.
1. Stainless Steel Flashing and Special Sections: Provide 26 gauge stainless steel flashing termination strips with with sealant ledge as recommended by flashing manufacturer. Refer to flashing details on drawings.
- G. Stainless Steel Drip Plate:
1. 26 gage, type 304 stainless steel.
 2. Factory formed, hemmed drip edge.
 3. Prefabricated inside, outside corners and end dams.
 4. Install in conjunction with flexible through wall flashing. Refer to flashing details on drawings.

5. Install in strict accordance with manufacturer recommendations

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of flashing. Remove all deleterious materials from surfaces to be flashed.

3.02 INSTALLATION

- A. General: Install flashing to dry surfaces at air and surface temperatures of -4°C (25°F) and above in accordance with manufacturer's recommendations at locations indicated on Construction Documents.
- B. Through Wall Flashing – Referred to on drawings as “Through Wall Flashing”: All flashing and accessories shall be installed in accordance with manufacturer's printed instructions, contract documents.
- C. Accessories:
 1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture, apply surface conditioner by spray, brush, or roller at the rate recommended by manufacturer, prior to flashing installation. Allow surface conditioner to dry completely before flashing application.
 2. Apply Primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to flashing installation. Allow primer to dry completely before flashing application.
 3. Provide stainless steel termination bar with a full bed of manufacturer's recommended sealant at the top of all flexible flashing. Refer to drawings for detail.
 4. Encapsulate stainless steel termination bar with the vapor permeable, fluid applied membrane air barrier per the manufacturer's strict instructions.
 5. Refer to drawings for details.
 6. Refer to manufacturers details for inside and outside wall flashing corners

PROJECT WALL FLASHING WARRANTY

NAME OF PROJECT: _____

PROJECT LOCATION: _____

**GENERAL
CONTRACTOR:** _____

ADDRESS: _____

**DATE OF
ACCEPTANCE:** _____ **DATE OF
EXPIRATION:** _____

- D. The Wall Flashing Contractor and the General Contractor do hereby certify that the wall flashing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved wall flashing manufacturers' recommendations.
- E. The Wall Flashing Contractor and the General Contractor do hereby guarantee the wall flashing and associated work including but not limited to all underground vertical and horizontal wall flashing to be water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of Beneficial Occupancy of the project.
- F. Subject to the terms and conditions listed below, the Wall Flashing Contractor and the General Contractor also guarantee that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the wall flashing manufacturers' recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including. Anticipated life of the wall flashing systems and the best standards applicable to the particular wall flashing type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within seven (7) calendar days upon proper notification of leaks or defects by the Government.
1. During the Guarantee Period, if the Government allows alteration of the work by anyone other the Wall Flashing Contractor or the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything affected by, this Guarantee shall become null and void upon the date of said alterations

2. Future building additions will not void this Guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the wall flashed areas, and any damage caused by such addition. If this contract is for wall flashing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing.
3. The Government shall promptly notify the Wall Flashing Contractor or the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Wall Flashing Contractor or the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed

This _____ day of _____.

Wall Flashing Contractor's Authorized Signature	General Contractor's Authorized Signature
--	--

Typed Name and Title	Typed Name and Title
-----------------------------	-----------------------------

Notary Public

END OF SECTION

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Roof-edge drainage systems.

1.02 RELATED REQUIREMENTS:

- A. Section 01 7419 - Construction Waste Management and Disposal
- B. Section 05 5000 – Metal Fabrications
- C. Section 06 1000 – Rough Carpentry
- D. Section 07 4113 – Metal Roof Panels
- E. Section 07 6200 – Sheet Metal Flashing and Trim
- F. Section 07 9200 – Joint Sealants

1.03 PREINSTALLATION CONFERENCE:

- A. Conduct conference at Project site.
- B. Meet with Contracting Officer, Contracting Officer Representative, Architect, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
- C. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
- D. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
 2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 4. Detail termination points and assemblies, including fixed points.
 5. Include details of special conditions.
- C. Samples: For each type of roof specialty and for each color and texture specified.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- E. Samples for Verification:
1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 2. Include roof-edge specialties and roof-edge drainage systems made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.
- F. Sustainability Submittals:
1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For roof-edge flashings for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, including fascia, gutter, and downspout approximately 10 ft. (3.0 m) long, including supporting construction, seams, attachments, underlayment, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Contracting Officer specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Beneficial Occupancy.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.09 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 0100 Special Project Roofing Warranty

- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Beneficial Occupancy.

1.11 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content:
 - 1. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Recycled Content: For Steel Products: Minimum Total Recovered Materials Content - 30%
- C. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-105. Identify materials with FM Approvals' markings.
- D. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested in accordance with SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.

- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

2.02 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 ft. (3.6 m, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.
 - 2. Gutter Profile: As indicated on the drawings and in accordance with SMACNA's "Architectural Sheet Metal Manual."
 - 3. Minimum Gutter Size: 4-1/2 inches deep by 6 inches wide.
 - 4. Corners: Factory mitered and continuously welded.
 - 5. Gutter Supports: Gutter brackets and Straps as recommended by manufacturer for application and required performance standards.
 - 6. Special Fabrications: Radiussed sections .
- B. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.
 - 2. Size: 3" by 4"
- C. Zinc-Coated Steel Finish: Three-coat fluoropolymer
 - 1. Color: As selected by the Government from manufacturer's full range and matching approved roofing / flashing material color.

2.03 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

2.04 UNDERLAYMENT MATERIALS

- A. Roofing Underlayment: Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 Mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

2.05 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Galvanized-Steel Sheet Finishes:
 - 1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 2605, meeting solar reflectance index and warranty requirements.
 - 2. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply continuously under roof-edge specialties.
 - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.03 INSTALLATION, GENERAL

- A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 ft. (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.04 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

- A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 ft. (15.2 m) apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - 1. Connect downspouts to underground drainage system indicated.

3.05 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 9005 - JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.
- C. Product Data for HPSB Compliance: For adhesives, including printed statement of VOC content.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants 2017.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- D. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. Section 01 3001 - Submittals
- B. Sustainability Submittals:
 - 1. For products containing VOCs, documentation (material safety data sheets (MSDS), third-party certificates, or test reports) showing printed statement of VOC content.
 - 2. VOC Content Limitations: For the specified products, submit documentation of conformance with Specification Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Product Data: Provide data indicating sealant chemical characteristics.
- D. Samples, Submit two samples, in size required to illustrate sealant colors for selection.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.06 MOCK-UP

- A. Refer to 01 4000.

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a the specified warranty periods.
 - 1. Unless noted otherwise, provide manufacturer's standard 5 year material warranty.
 - 2. Provide additional manufacturer's warranties listed for specific products.
- C. Provide General Contractor's Project Joint Sealant Warranty at the back of this specification section. Warranty to be signed by the Joint Sealant Contractor and General Contractor.
- D. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.09 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with the lowest possible VOC content.

PART 2 PRODUCTS

2.01 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

- B. Type I - General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M ; single component, ultra low-mod.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum in accordance with ASTM C719
 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Elongation: 1,000% when testing in accordance with ASTM D412
 6. Tensile Strength: 120 psi, ultimate, when testing in accordance with ASTM D412
 7. Tear Strength: 30ppi, ultimate, when testing in accordance with ASTM D624
 8. Ozone/UV Resistance: Excellent.
 9. Service Temperature Range: [-60] to [300] degrees F ([-51] to [149] degrees C).
 10. Color: To be selected by the Government from manufacturer's full range.
 11. Applications: Use for:
 - a. Vertical and horizontal construction joints between masonry/concrete/stone to masonry/concrete/stone.
 12. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- C. Type II - General Purpose Exterior Sealant: Silicone ; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; ot expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661
 3. Cure Type: Single-component, neutral moisture curing
 4. Service Temperature Range: [-60 to 300] degrees F ([-51 to 149] degrees C).
 5. Elongation: 700% when testing in accordance with ASTM D412
 6. Tensile Strength: 200 psi, ultimate, when testing in accordance with ASTM D412

7. Tear Strength: 40 ppi, ultimate, when testing in accordance with ASTM D624
 8. Peel Strength: 30 pli, when tested in accordance with ASTM C794
 9. Ozone/UV Resistance: Excellent, when tested in accordance with ASTM D1149
 10. Color: To be selected by the Government from manufacturer's full range.
 11. Applications: Use for:
 - a. All other vertical and horizontal construction joints not listed in sealant type I & III.
 12. Warranties: In addition to manufacturer's standard product warranties, Provide manufacturer's 20 year Non-Staining and 20 year Structural Adhesion limited warranties. Provide manufacturer's compatibility testing as required.
- D. Type III - Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
1. Face color: match adjacent materials.
 2. Size as required to provide weathertight seal when installed.
 3. None staining in accordance with ASTM C510
 4. Excellent UV Resistance
 5. Excellent Resistance to Aging
 6. Excellent Mildew Resistant
 7. 21 psi min (145 kPa) tensile strength in accordance with ASTM D3574
 8. 0.34 Btu. in/hr. ft² - °F (0.05 w/m °C) Thermal Conductivity in accordance with ASTM C518
 9. Rate of Air Leakage Through Curtain Walls in accordance with ASTM E283: Passed.
 10. Water Penetration of Curtain Walls by Uniform Static Air Pressure Difference in accordance with ASTM E331: Passed, up to 20.88 PSF
 11. Structural Performance of Curtain Walls by Uniform Air Pressure Difference (Gust Loads) in accordance with ASTM E330: Passed: + 62.66 PSF, -56.39 PSF
 12. Applications: Use for:
 - a. Exterior wall expansion joints used in conjunction with sealant Type I.

- E. Type IV - General Purpose Interior Sealant: Siliconized Acrylic Latex; ASTM C 834, Type OP, single component, paintable.
1. Extrudability, ASTM C1183: 6 g/s
 2. Artificial Weathering, ASTM C732: Passes
 3. Wash Out, ASTM C732: None
 4. Slump:
 - a. ASTM C732: None
 - b. ASTM D2202: 2 mm
 5. Cracking, ASTM C732: None
 6. Discoloration, ASTM C732: None
 7. Adhesion Loss, ASTM C732: None
 8. Volume Shrinkage, ASTM C1241: 22.4% (Type OP), 35.3% (Type C)
 9. Low Temp Flexibility, ASTM C734: Non cracks, no adhesion loss
 10. Extension - Recovery, ASTM C736: 93.7%
 11. Extension - Adhesion, ASTM C736: None
 12. Stain Index, ASTM D2203: 0 mm
 13. Movement Capability: +/-12.5%
 14. Flame Spread, ASTM E84: 10
 15. Smoke Development, ASTM E84: 0
 16. Color: To be selected by the Government from manufacturer's standard range.
 17. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Other interior joints for which no other type of sealant is indicated.
- F. Type V - General Purpose Interior Sealant: Medium Modulus silicone sealant
1. Movement Capability: Plus and minus 50 percent, minimum.
 2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661

3. Cure Type: Single-component, neutral moisture curing
 4. Service Temperature Range: [-60 to 300] degrees F ([-51 to 149] degrees C).
 5. Elongation: 700% when testing in accordance with ASTM D412
 6. Tensile Strength: 200 psi, ultimate, when testing in accordance with ASTM D412
 7. Tear Strength: 40 ppi, ultimate, when testing in accordance with ASTM D624
 8. Peel Strength: 30 pli, when tested in accordance with ASTM C794
 9. Ozone/UV Resistance: Excellent, when tested in accordance with ASTM D1149
 10. Color: To be selected by the Government from manufacturer's full range.
 11. Color: To be selected by the Government from manufacturer's standard range.
 12. Applications: Use for:
 - a. Joints between aluminum door and window frames and adjacent wall surfaces.
- G. Type VI - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses M and A; single component, neutral curing, mildew resistant.
1. Cyclic Movement, ASTM C719: +/- 50
 2. Elongation, Ultimate, ASTM D412: 450
 3. Hardness (Shore A), ASTM C661: 25-35
 4. Ozone/UV Resistance: Excellent
 5. Peel Adhesion, ASTM C794: Pass
 6. Service Temperature Rang (°F): -60 to 100
 7. Tensile Strength, ASTM C1135
 - a. 100% Elongation (psi): 45-55
 - b. Ultimate (psi): 165
 8. Fungi Resistance, ASTM G21: No growth < 2 ug
 9. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.

- H. Type VII - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and A; multi- component, type M
1. % Solids: 92%
 2. Specific Gravity: 1.2
 3. Extrusion Rate, ASTM C1183: 4 seconds
 4. Hardness, ASTM C661: 30 to 35
 5. Weight Loss, ASTM C1246: 12%
 6. Stain and Color Change, ASTM C510: No visible color change, No stain
 7. Accelerated Weathering, ASTM C793: Passes
 8. Movement Capability, ASTM C719: +/- 25%
 9. Tensile Strength, ASTM D412: 200 to 250 psi
 10. Elongation, ASTM D412: 500 to 650%
 11. Color: To be selected by the Government from manufacturer's full range.
 12. Applications: Use for:
 - a. Expansion joints in floors.
 - b. Joints between hard floor tile and hard floor tile and hard floor tile and adjacent wall surfaces for hard tile expansion joints.
- I. Type VIII - Concrete Joint Sealant: Polyurethane; ASTM C 920, Class 50, Uses T, and M; multi- component (type M), Grade NS vertical and horizontal
1. % Solids: 92%
 2. Specific Gravity: 1.06
 3. Low Temp Flexibility, ASTM C793: Passes at -15 °F (-9° C)
 4. Hardness, ASTM C661: 30 +/-3
 5. Weight Loss, ASTM C1246: Passes
 6. Stain and Color Change, ASTM C510: No color change, No stain
 7. Adhesion-in-Peel, ASTM C794: >10 pli (pass)
 8. Accelerated Weathering, ASTM C793: Passes

9. Movement Capability, ASTM C719: +/- 50%
10. Color: as selected by the Government from manufacturer's full range of colors..
11. Applications: Use for:
 - a. Joints in sidewalks and curb and gutters
 - b. Joints in concrete walls

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application, and compatible with joint substrates.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 5. All backer rods shall be as recommended by sealant manufacturer for specific use.
- D. Tooling Agent: Agent recommended by material manufacturer to ensure contact of material with inner joint faces.
- E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application. Provide self adhering tape where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

PROJECT JOINT SEALANT WARRANTY

PROJECT : _____

LOCATION: _____

OWNER : _____

**WATERPROOFING
CONTRACTOR** _____

ADDRESS _____

DATE OF ACCEPTANCE _____ **DATE OF EXPIRATION** _____

- A. The joint sealant contractor and general contractor do hereby certify that the above and underground work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved joint sealants manufacturers' recommendations.
- B. The joint sealant contractor and general contractor do hereby guarantee the joint sealants and associated work including but not limited to all above and underground vertical and horizontal joint sealants to be water tight and free from all leaks, due to faulty or defective materials and workmanship for a period of ten (10) years, starting on the date of Beneficial Occupancy of the project.
- C. Subject to the terms and conditions listed below, the joint sealants contractor and general contractor also guarantee that during the guarantee period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the joint sealant manufacturers recommendations as are necessary to correct faulty and defective work and/or materials which may develop in the work including. Anticipated life of the joint sealant systems and the best standards applicable to the particular joint sealant type in value and in accordance with construction documents as are necessary to maintain said work in watertight conditions, and further, to respond on or within seven (7) calendar days upon proper notification of leaks or defects by the Government.
- D. During the guarantee period, if the Government allows alteration of the work by anyone other the joint sealant contractor or general contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything affected by, this guarantee shall become null and void upon the date of said alterations.

- E. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the joint sealant areas, and any damage caused by such addition. If this contract is for joint sealant of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing.
- F. The Government shall promptly notify the Joint Sealant Contractor or General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Joint Sealant Contractor or General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF,

THIS INSTRUMENT HAS BEEN DULY EXECUTED THIS _____ DAY OF
_____(YEAR).

GENERAL CONTRACTOR'S JOINT SEALANT CONTRACTOR
CONTRACTOR'S AUTHORIZED AUTHORIZED SIGNATURE SIGNATURE

NAME AND TITLE TYPED
TYPED NAME AND TITLE

Notary Public

END OF SECTION

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SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements.
- B. Section 01 7419 - Construction Waste Management and Disposal
- C. Section 04 2000 - Unit Masonry
- D. Section 08 7100 - Door Hardware.
- E. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- F. Section 09 9113 - Exterior Painting: Field painting.
- G. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. HMMA: Hollow Metal Manufacturers Association.
- B. NFPA: National Fire Protection Association.
- C. SDI: Steel Door Institute.
- D. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2007 (R2011).
- D. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.

- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2014.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2015.
- H. ASTM A1008/A1008M - 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 2015.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2014.
- J. ASTM F2247 - Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method) 2018.
- K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2014.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2009.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- O. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2006.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2012.
- S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.
- T. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.
- U. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.

- V. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for Submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)/Total weight of products provided
 - b. Include total weight of products provided

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.08 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content:

1. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- B. Combined Requirements:** If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

C. Product Performance:

1. Air leakage for fenestration and doors shall be determined in accordance with NFRX 400. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the manufacturer.
 - a. Air leakage shall not exceed 1.0 cfm/ft² for glazed swinging entrance doors and 0.4 cfm/ft² for all other products.
2. U-factors shall be determined in accordance with NFRC 100. U-Factors shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the manufacturer.
 - a. Assembly U-value for opaque doors shall not exceed 0.700.
3. Labeling of Doors: The U-factor and the air leakage rate for all manufactured doors installed between conditioned space, semi-heated space, unconditioned space, and exterior space shall be identified on a permanent name-plate installed on the product by the manufacturer.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A40 metallic coating.
- D. Recycled Content: For Steel Products: Minimum Total Recovered Materials Content - 30%

2.03 HOLLOW METAL DOORS

- A. Type HM EXT, Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.

- d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum., unless required otherwise for blast resistant doors
- 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
- 3. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
- 4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C 1363 .
- 5. Weatherstripping: Refer to Section 08 7100.
- 6. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum. unless required otherwise for blast resistance.
 - 3. Weatherstripping in Hardware Specification Section: 08 7000.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.05 ACCESSORIES

- A. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- B. Stops and Moldings:
 - 1. Moldings for Glazed Lites in Doors & Windows: Minimum 0.032-inch (0.8 mm) thick, same material as door face sheet. Metal lite kits are to be flush and shall not require shim kits for door hardware.
 - 2. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
 - 3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.

- C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
 - a. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2) Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.07 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration with flush door cap.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
 - a. Single-Door Frames: Three door silencers.
 - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 electrical Sections.

- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

3.03 INSTALLATION

- A. Hollow Metal Frames and Stainless Steel Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 - g. Remove temporary “shipping spreader bars” before installation.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
- a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
- a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
- a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
2. Smoke-Control Doors: Install doors according to NFPA 105.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 08 3000 - OVERSIZED HOLLOW METAL DOORS AND FRAMES

GENERAL

1.01 SECTION INCLUDES

- A. Non-rated, insulated, exterior hollow steel swinging doors.

1.02 RELATED SECTIONS

- A. Section 07 9005 - Joint Sealers
- B. Section 08 7100 - Door Hardware
- C. Section 09 9113 – Exterior Painting
- D. Section 09 9123 – Interior Painting

1.03 REFERENCES

- A. ASTM A653/A653M-15el - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. HMMA 802-07 - Manufacturing of Hollow Metal Doors and Frames.
- C. HMMA 840-07 - Installation and Storage of Hollow Metal Doors and Frames.
- D. HMMA 841-07 - Tolerances and Clearance for Commercial Hollow Metal Doors and Frames.

1.04 SUBMITTALS

- A. Product Data: Provide product data on standard door and frame construction.
- B. Shop Drawings: Indicate door and frame elevations, internal reinforcement, anchor types and spacing, closure methods, and location of cut-outs for hardware.
- C. Sustainability Submittals:
 - 1. For products having recycled content, documentation indicating percentages by weight of post consumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content).
 - b. Include total weight of products provided.

1.05 QUALITY ASSURANCE

- A. Perform Work to requirements of HMMA (Hollow Metal Manufacturers Association) standards.
- B. Manufacturer: Minimum 5 years documented experience manufacturing hollow metal door and frame assemblies.
- C. Pre-installation Meeting: Convene a pre-installation meeting 2 weeks before installation of oversize door and frame assemblies. Require attendance from relevant subcontractors, consultants, and manufacturer's representative. Review installation and coordination with other work.

1.06 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high recycled content.
- B. See Part 2 of this specification section for specific recycled content thresholds, if applicable.

1.07 DELIVERY, STORAGE AND PROTECTION

- A. Section 01 6000: Transport, handle, store, and protect products.
- B. Comply with HMMA 840 and manufacturer's written instructions.
- C. Weld minimum two temporary jamb spreaders per frame prior to shipment.
- D. Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.
- E. Store in vertical position, spaced with blocking to permit air circulation between components.
- F. Store materials out of water and covered to protect from damage.
- G. Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-phosphate primer.

1.08 WARRANTY

- A. Manufacturer's Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

PRODUCTS

2.01 MATERIALS

- A. Sheet Steel: Galvanized steel to ASTM A653/A653M.
 - 1. Coating designation G90 for exterior door assemblies.
- B. Reinforcement Channel: To CSA G40.20/G40.21, coating designation to ASTM A653/A653M.
- C. Reinforcement: Same material as sheet steel.
- D. Door Core Material: Manufacturer's standard core material/construction and in compliance with requirements. U-Value of 0.50, when tested in accordance with ASTM C1363.
- E. Recycled Content: For steel products: Minimum Total Recovered Materials Content - 30%.

2.02 ACCESSORIES

- A. Exterior Top Caps: Rigid polyvinylchloride extrusion.

2.03 FABRICATION

- A. Doors: Hollow Steel
 - 1. Hollow Steel Construction:
 - a. Welded stiffener construction, longitudinal edges welded, filled, and sanded with no visible edge seams.
 - b. Top and Bottom Channels: Inverted, recessed, welded steel channels.
 - c. Astragals: Metal T shaped astragals for double doors.
 - d. Fabricate doors with hardware reinforcement plates welded in place.

2.04 FRAMES: PRESSED STEEL

- A. Pressed Steel:
 - 1. Frames: 14 gauge thick base metal thickness, welded type construction, mitred corners.
 - 2. Mullions for Double Doors: Removable type.
 - 3. Fabricate frames with hardware reinforcement plates welded in place.

4. Reinforce frames wider than 1200 mm (48 inches) with roll formed steel channels fitted tightly into frame head, flush with top.

2.05 PRE-INSTALLATION OF DOOR HARDWARE

- A. Hardware: Heavy weight hinges and door latches to be supplied by Section 08 7100.

2.06 FINISHES

- A. Factory Finish: Factory applied zinc phosphate primer to be applied to all exposed surfaces. Touch-up only, where product has been welded and ground smooth.

EXECUTION

3.01 INSTALLATION

- A. Install components to manufacturer's written instructions.
- B. Install doors and frames to HMMA 840 standards.
- C. Utilize welders certified by American Welding Society (AWS) for field welding.
- D. Coordinate with adjacent wall construction for anchor placement.
- E. Set frames plumb, square, level and at correct elevation.
- F. Allow for deflection to ensure that structural loads are not transmitted to frame.
- G. Adjust operable parts for correct clearances and function.
- H. Finish paint in accordance with Section 09 9113 / 09 9123.
- I. Touch up painted finishes where damaged.

3.02 ERECTION TOLERANCES

- A. Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than $\pm 1/16$ in (1.5mm) in compliance with HMMA 841.

3.03 FIELD QUALITY CONTROL

- A. Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.
- B. Provide manufacturer's representative to inspect door installation, and test minimum ten (10) cycles of operation. Correct any deficient doors.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for hollow steel doors.
- B. Thresholds.
- C. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 3323 – Overhead Coiling Doors

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- B. BHMA A156.1 - American National Standard for Butts and Hinges; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.1).
- C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; Builders Hardware Manufacturers Association; 2011 (ANSI/BHMA A156.2).
- D. BHMA A156.3 - American National Standard for Exit Devices; Builders Hardware Manufacturers Association; 2008 (ANSI/BHMA A156.3).
- E. BHMA A156.4 - American National Standard for Door Controls - Closers; Builders Hardware Manufacturers Association, Inc.; 2008 (ANSI/BHMA A156.4).
- F. BHMA A156.5 - American National Standard for Auxiliary Locks & Associated Products; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.5).
- G. BHMA A156.6 - American National Standard for Architectural Door Trim; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.6).
- H. BHMA A156.7 - American National Standard for Template Hinge Dimensions; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.7).
- I. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; Builders Hardware Manufacturers Association, Inc.; 2010 (ANSI/BHMA A156.8).

- J. BHMA A156.12 - American National Standard for Interconnected Locks & Latches; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.12).
- K. BHMA A156.13 - American National Standard for Mortise Locks & Latches; Builders Hardware Manufacturers Association; 2005 (ANSI/BHMA A156.13).
- L. BHMA A156.16 - American National Standard for Auxiliary Hardware; Builders Hardware Manufacturers Association; 2008 (ANSI/BHMA A156.16).
- M. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).
- N. BHMA A156.21 - American National Standard for Thresholds; Builders Hardware Manufacturers Association; 2009 (ANSI/BHMA A156.21).
- O. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012 (ANSI/BHMA A156.22).
- P. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
- Q. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADAAG - Americans with Disabilities Act, Accessibility Guidelines).
- R. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.
- S. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.
- T. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.
- B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- C. Convey the Government's keying requirements to manufacturers.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.

- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.
- C. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.
- D. Keying Schedule: Submit for approval of the Contracting Officer Representative.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- F. Keys: Deliver with identifying tags to Government by security shipment direct from hardware supplier.
- G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in the Government's name and registered with manufacturer.
- H. Maintenance Materials and Tools: Furnish the following for Government use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Lock Cylinders: Ten for each master keyed group.
 - 3. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 5 years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year warranty for door closers.

- C. All other door hardware components to have a one year limited warranty.

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

- A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
- B. Provide all items of a single type of the same model by the same manufacturer.
- C. Provide products that comply with the following:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
 - 3. Applicable provisions of NFPA 101, Life Safety Code.
 - 4. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
- D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.
- E. Finishes: Identified in schedule.

2.02 HINGES

- A. Hinges: Provide hinges on every swinging door.
 - 1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 - 2. Provide ball-bearing hinges at all doors having closers.
 - 3. Provide hinges in the quantities indicated.
 - 4. Provide non-removable pins on exterior outswinging doors.
- B. Butt Hinges: Comply with BHMA A156.1 and A156.7; standard weight, unless otherwise indicated.
 - 1. Provide hinge width required to clear surrounding trim.
- C. Quantity of Hinges Per Door:
 - 1. Doors up to 60 inches (1.5 m) High: Two hinges.

2. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.
3. Doors 90 inches (2.3 m) High up to 120 inches (3 m) High: Four hinges.
4. Doors over 120 inches (3 m) High: One additional hinge per each additional 30 inches (762 mm) in height.

2.03 PUSH/PULLS

- A. Push/Pulls: Comply with BHMA A156.6.
1. Provide push and pull on doors not specified to have lockset, latchset, exit device, or auxiliary lock.
 2. On solid doors, provide matching push plate and pull plate on opposite faces.

2.04 LOCKS AND LATCHES

- A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
1. Hardware Sets indicate locking functions required for each door.
 2. If no hardware set is indicated for a swinging door provide an office lockset.
 3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
 4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.
- B. Lock Cylinders: Manufacturer's standard tumbler type, seven pin standard core.
1. Provide cams and/or tailpieces as required for locking devices required.
- C. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer.
1. Stanley Best (BE): Provide all cylinders and keying system from Best in order to match the current Government Best Access MX-8 keying system.
 2. Ensure all door hardware provided is compatible with and capable of receiving specified Best Access system core/cylinder.
 3. Substitutions not allowed.
- D. Keying: as approved by Contracting Officer in approved keying schedule.
1. Key to existing keying system.

2.05 MORTISE LOCKSETS

- A. Locking Functions: As defined in BHMA A156.13, and as follows:
 - 1. Passage: F01.
 - 2. Privacy: F19, or F02 with retraction of deadbolt by use of inside lever/knob.
 - 3. Office: F04, key not required to lock, remains locked upon exit.
- B. Ensure all locksets are compatible with and able to receive best access core/cylinder.

2.06 FLUSHBOLTS

- A. Flushbolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - 1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
 - 2. Floor Bolts: Provide dustproof strike except at metal thresholds.
- B. Manual Flushbolts: Provide lever extensions for top bolt at over-size doors.

2.07 EXIT DEVICES

- A. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
 - 1. Entry/Exit, Always-Unlocked: Outside lever unlocked, no outside key access, no latch holdback.
 - 2. Entry/Exit, Free Swing: Key outside retracts latch, latch holdback (dogging) for free swing during occupied hours, not fire-rated; outside trim must be specified as lever or pull.
- B. Ensure all exit devices are compatible with and able to receive best access core/cylinder.

2.08 CLOSERS

- A. Closers: Complying with BHMA A156.4.
 - 1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
 - 2. Provide a door closer on every exterior door.
 - 3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.

4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.

2.09 STOPS AND HOLDERS

- A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
 1. Provide wall stops, unless otherwise indicated.
 2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
 3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

2.10 GASKETING AND THRESHOLDS

- A. Gaskets: Complying with BHMA A156.22.
 1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
 2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
 - a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
 3. On each exterior door, provide door bottom sweep, unless otherwise indicated.
- B. Thresholds:
 1. At each exterior door, provide a threshold unless otherwise indicated.
 2. Field cut threshold to frame for tight fit.
- C. Fasteners At Exterior Locations: Non-corroding.

2.11 PROTECTION PLATES AND ARCHITECTURAL TRIM

- A. Protection Plates:
 1. Kickplate: Provide on push side of every door with closer, except storefront and all-glass doors.

2. Mop Plates:

2.12 KEY CONTROLS

- A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Do not install surface mounted items until finishes applied to substrate are complete.
- D. Mounting heights for hardware from finished floor to center line of hardware item:
 1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."

3.03 FIELD QUALITY CONTROL

- A. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01 7000.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000.
- B. Do not permit adjacent work to damage hardware or finish.

HARDWARE SETS

Set: 1.0

Doors: 101, 103

Description: Entry

3	Hinge	TA2314 NPR 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (Storeroom)	JNR 8805FL A620	626	YA
1	Cylinder	Best SCIF as required	626	BE
1	Surface Closer	CLP8501 TBGN	689	NO
1	Threshold	271A		PE
1	Gasketing	S88D		PE
1	Rain Guard	346C x LAR		PE
1	Sweep	315CN		PE
1	Armor Plate	K1050 4" x 34"	US32D	RO

Set 2.0

Doors: 102

Description: Oversized Entry

10	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Armor Plate	K1050 26" x 8"	US26D	RO
4	Flush Bolt	585-24	US26	RO
2	Sweep	315CN		PE
1	Rain Guard	346C x LAR		PE
1	Gasketing	S88D		PE

END OF SECTION

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SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 7. Marble, granite, slate, and other natural stones.
 - 8. Floors, unless specifically indicated.
 - 9. Ceramic and other types of tiles.
 - 10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 11. Glass.
 - 12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

- B. Section 05 5000 - Metal Fabrications: Shop-primed items.
- C. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1 2016.
- F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- G. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with the Contracting Officer Representative before preparing samples, to eliminate sheens definitely not required.
 - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Government's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.07 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 10 feet (3 m) long by 10 feet (3 m) wide, illustrating paint color, texture, and finish.

- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by the Government.
- E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by the Government from the manufacturer's full line.
- E. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint CE-OP-3L - Masonry (CMU), Opaque, Latex, 3 Coat:
1. One coat of block filler; MPI #4: 16.0-21.0 mils wet; 8.0-10.5 dft., 50+/- 2% volume solids, <50 g/l VOC, passes Wind Driven Rain test method TT-C-555b
 2. Semi-gloss: Two coats of latex enamel; MPI #11: 4.0 mils wet; 1.6 mils dft., 39 +/- 2% volume solids, <50 g/l VOC
- B. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer; MPI #79: 6.0-8.0 mils wet; 3.3-4.4 mils dft, 55 +/- 2% volume solids, <390 g/l VOC
 2. Gloss: Two coats of alkyd enamel; MPI#9: 4.0-6.0 mils wet, 1.9-5.0 mils dft, 63 +/- 2% volumes solids, < 420 g/l VOC
- C. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. One coat galvanize primer
 2. Gloss: Two coats of alkyd enamel;

- a. MPI #79: 6.0-8.0 mils wet; 3.3-4.4 mils dft, 55 +/- 2% volume solids, <390 g/l VOC
- b. MPI #76: 3.0-8.0 mils wet; 1.9-5.0 mils dft, 63 +/- 2% volume solids, <320 g/l VOC

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Concrete Masonry: Interior/Exterior Latex Block Filler.
 - 2. Steel, Uncoated: Anti-Corrosive Alkyd Primer for Metal.
 - 3. Steel --Shop Primer: Interior/Exterior Quick Dry Alkyd Primer for Metal.
 - 4. Galvanized Steel: Water Based Primer for Galvanized Metal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Commencement of paint operations indicates applicators acceptance of surfaces and conditions.
- C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Beneficial Occupancy.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Mechanical and Electrical:
 - a. Paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. Paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 5. Electrical devices and plates.
 - 6. Door hardware and cabinet hardware.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- C. Section 05 5000 - Metal Fabrications: Shop-primed items.

- D. Section 08 1113 - Hollow Metal Doors and Frames
- E. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- E. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- F. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.05 SUBMITTALS

- A. See Section 01 3001 - Submittals for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 3. Manufacturer's installation instructions.
 - 4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Contracting Officer Representative before preparing samples, to eliminate sheens definitely not required.
 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Sustainability Submittals:
1. For products containing VOCs, documentation (material safety data sheets (MSDS), third-party certificates, or test reports) showing printed statement of VOC content.
 2. VOC Content Limitations: For the specified products, submit documentation of conformance with Specification Section 01 6116 – Volatile Organic Compound (VOC) Content Restrictions.
- G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- H. Maintenance Materials: Furnish the following for the Government's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.07 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 10 feet (3 m) long by 10 feet (3 m) wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by the Government.
- E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

1.10 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with the lowest possible VOC content.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions. Paint Manufacturer must be listed as an MPI approved company.
- B. Primer Sealers: Same manufacturer as top coats.
- C. Block Fillers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by the Government from the manufacturer's full line.
- E. Colors: As indicated on drawings.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under or as indicated on drawings.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, plaster, uncoated steel, and shop primed steel.

1. Two top coats and one coat primer.
 2. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - c. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
 - d. Semi-Gloss: MPI gloss level 5; use this sheen at opaque wood and metal..
 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
1. Shop primer as recommended by manufacturer of top coat.
 2. Finish:
 - a. MPI #118, Flat (<50 g/l voc) (25%+ volume solids)
 - b. MPI #155, EgShel (<50 g/l voc) (33%+ volume solids)
- C. Paint I-TR-C - Transparent Finish on Concrete Floors.
1. 2 coats sealer.
 2. Sealer: Water Based for Concrete Floors.
 - a. Products:
 - 1) MPI #31 (<300 g/l voc) (68% +/- 2% volume solids) (passed ASTM D4060)
 - 2) or MPI #83 (<300 g/l voc) (68% +/- 2% volume solids) (passed ASTM D4060)
 - 3) Provide 2 coats installed in strict accordance of manufacturer.
 - 4) Test in accordance with ASTM F710 prior to installation to verify compliance with manufacturer.
 - 5) Provide surface preparation and application per manufacturer's recommendations.

D. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:

1. One coat of block filler: (16.0 - 21.0 mils wet; 8.0 – 10.5 mils dry)
 - a. MPI #4 – CMU (<50 g/l voc) (50% +/- 2% volume solids)
2. One coat of masonry primer (5.0 - 12.0 mils wet; 2.1 – 5.1 mils dry)
 - a. MPI #3 – Smooth Masonry (50 g/l voc) (43% +/- 2% volume solids)
3. Semi-gloss: Two coats of latex enamel:
 - a. MPI #141 or MPI #141X (<50 g/l voc) (35% +/- 2% volume solids) (pass scrub resistance test: ASTM D2486)

E. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:

1. One coat of latex primer
 - a. MPI #107, MPI #107X, MPI #134 (50 g/l voc) (38% +/- 2%) (5.0 – 10.0 mils wet)
2. Semi-gloss: Two coats of latex enamel:
 - a. MPI #140, MPI #140X (<50 g/l voc) (35% +/- 2%) (6.0 – 12.0 mils wet)

F. Paint MgI-OP-3L - Galvanized Metals, Latex, 3 Coat:

1. One coat galvanize primer:
 - a. MPI #107. MPI #107X, MPI #134 (50 g/l voc) (38% +/- 2%) (5.0 – 10.0 mils wet)
2. Gloss: Two coats of latex enamel:
 - a. MPI #148, MPI #148X (<50% +/- 2%) (6.0 – 12.0 mils wet)

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

1. Concrete/Plaster: Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
2. Concrete Masonry: Interior/Exterior Latex Block Filler; MPI #4.
3. Steel: Anti-Corrosive Alkyd Primer for Metal; MPI #79.

4. Steel --Shop Primer: Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
5. Galvanized Steel: Interior Water Based Primer for Galvanized Metal; MPI #134.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Commencement of paint operations indicates applicators acceptance of surfaces and conditions.
- C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 2. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.

- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Beneficial Occupancy.

END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3001 - Submittals for Submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.
- D. Sustainability Submittals:
 - 1. Documentation (material safety data sheets (MSDS), third-party certificates, or test reports) showing printed statement confirming that ozone depleting substances are not utilized in the product.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG or purpose specified and as indicated.

- B. Type Fire Extinguishers that contain no ozone-depleting substances such as CFCs, Hydrochlorofluorocarbons (HCFCs) or Halons per HPSB requirements: Carbon steel tank, with pressure gage.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound (4.54 kg).
 - 3. Finish: Baked polyester powder coat Red color.

2.02 FIRE EXTINGUISHER BRACKET

- A. Provide Standard Fire Extinguisher Bracket.

PART 3 EXECUTION

3.01 EXAMINATION

- A. If installed in metal stud wall provide solid wood blocking at top, bottom, and sides of cabinet locations prior to installation of cabinet
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place extinguishers in cabinets.
- C. Position cabinet signage at the Government.

END OF SECTION

SECTION 21 13 13 - WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION

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 B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

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 APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2019; Errata 19-1; Errata 19-2; TIA 19-1; TIA 19-2; TIA 19-3; TIA 19-4; Errata 19-3; Errata 20-4; TIA 19-5; TIA 19-6) Standard for the Installation of Sprinkler Systems
NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 291	(2016) 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
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UNDERWRITERS LABORATORIES (UL)

UL 199	(2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Modify existing wet pipe sprinkler system(s) in areas indicated on the drawings. 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. The contractor shall field verify existing sprinkler system piping layout and design the sprinkler system for the new storage room hydraulically.

1.2.1 Hydraulic Design

1.2.1.1 Basis for Calculations

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 flow test noted in this paragraph. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping, and 100 for existing underground piping..

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 or 8 psi for double check backflow preventer, whichever is greater.
- 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.

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.

1.2.2 Sprinkler Coverage

Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13.

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. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.
- d. 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 Contractor Quality Control approval. Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review.

The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to 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; GFittings; G

Valves, including gate, check, butterfly, and globe; G

Sprinklers; G

Pipe Hangers and Supports; G

SD-05 Design Data

]Hydraulic Calculations; G

SD-06 Test Reports

Test Procedures; G

SD-07 Certificates

Verification of Compliant Installation; G

Request for Government Final Test; 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

2 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 restraint of underground water main at point-of-entry into the building, 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 and related components.

1.4.1.2 Product Data

2 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.

1.4.2 Qualifications

1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level III 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 2 years prior to bid.

2.1.2 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.

2.1.3 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 175 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 175 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.

2.2.2 Pipe Hangers and Supports

Provide galvanized pipe hangers in accordance with NFPA 13.

2.2.3 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

2.3 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.

2.3.1 Upright Sprinkler

Upright sprinkler must be brass quick-response type and have a nominal K-factor of 8.0.

2.4 ACCESSORIES

2.4.1 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.

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.

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.

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 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, must be installed to provide maximum headroom.

3.3.2 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.

3.3.3 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. For copper tubing, pipe and groove dimensions must comply with the tolerances specified by the coupling 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.

3.3.4 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.

3.3.5 Pipe Penetrations

- a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted.

3.3.6 Drains

- a. Auxiliary drains must be provided as required by NFPA 13. Discharge to service sinks or similar plumbing fixtures is not permitted.

3.3.7 Identification Signs

Signs must be affixed to each auxiliary drain as required by NFPA 13.

3.4 FIELD QUALITY CONTROL

3.4.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level III Fire Sprinkler Technician, and the representative of the installing company, 30 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.

3.4.2 Pre-Government Testing

3.4.2.1 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 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

3.4.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the Contracting Officers Designated Representative (COR). 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. Submit request for test at least 15 calendar days prior to the requested test date.

3.4.3 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.

3.4.4 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. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the Contracting Officer. At this time, all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.5 MINIMUM SYSTEM TESTS

The system, including 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.

3.5.1 Aboveground Piping

3.5.1.1 Hydrostatic Test

The new portion of the system shall be isolated and 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.

3.6 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.

END OF SECTION

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SECTION 23 23 00 - REFRIGERANT PIPING

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 710 I-P	(2009) Performance Rating of Liquid-Line Driers
AHRI 720	(2002) Refrigerant Access Valves and Hose Connectors
AHRI 750 I-P	(2016) Performance Rating of Thermostatic Refrigerant Expansion Valves
AHRI 760 I-P	(2014) Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
AHRI 1370 I-P	(2017) Performance Rating of Electronic Expansion Valves

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15 & 34	(2013) ASHRAE Standard 34-2016 Safety Standard for Refrigeration Systems/ASHRAE Standard 34-2016 Designation and Safety Classification of Refrigerants-ASHRAE Standard 34-2016
ASHRAE 17	(2015) Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves
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 MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
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 B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
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 B16.26	(2018) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B31.1	(2020) Power Piping
ASME B31.5	(2020) Refrigeration Piping and Heat Transfer Components
ASME B31.9	(2020) Building Services Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals for Brazing and Braze Welding
AWS A5.31/A5.31M	(2012) Specification for Fluxes for Brazing and Braze Welding
AWS BRH	(2007; 5th Ed) Brazing Handbook
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS Z49.1	(2021) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2020) Standard Specification for Seamless Copper Tube
ASTM B280	(2020) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM D3308	(2012; R 2017) Standard Specification for PTFE Resin Skived Tape
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
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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-03 Product Data

Refrigerant Piping System

Qualifications

Refrigerant Piping Tests

Verification of Dimensions

SD-06 Test Reports

Refrigerant Piping Tests

SD-07 Certificates

Service Organization

SD-10 Operation and Maintenance Data

Maintenance;

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

Submit 2 copies of qualified procedures, and list of names and identification symbols of qualified welders and welding operators, prior to non-factory welding operations.

1.3.2 Contract Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation is the Contractor's responsibility. Replace any materials found to be damaged at

the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter.

1.5 MAINTENANCE

1.5.1 General

Submit Data Package 2 plus operation and maintenance data complying with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

- a. Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship and that have been in satisfactory commercial or industrial use for 2 years prior to bid opening.
- b. The 2 year use must include applications of equipment and materials under similar circumstances and of similar size. The 2 years' experience 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 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 manufacturer's factory tests, can be shown.
- c. Products must be supported by a service organization. System components must be environmentally suitable for the indicated locations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations must be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- d. Exposed equipment moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired. Welding and cutting safety requirements must be in accordance with AWS Z49.1.
- e. Provide the manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component. Highlight the data to show information such as, but not limited to, material, size, options, performance charts, and curves in adequate detail to demonstrate compliance with contract requirements. Include the manufacturer's recommended installation instructions and procedures in the data provided. Provide data for the following components as a minimum:

- (1) Piping and Fittings
- (2) Valves
- (3) Piping Accessories
- (4) Pipe Hangers, Inserts, and Supports

2.2 REFRIGERANT PIPING SYSTEM

Provide refrigerant piping, valves, fittings, and accessories in accordance with ASHRAE 15 & 34 and ASME B31.5, except as specified herein. Refrigerant piping, valves, fittings, and accessories must be compatible with the fluids used and capable of withstanding the pressures and temperatures of the service. Refrigerant piping, valves, and accessories used for refrigerant service must be cleaned, dehydrated, and sealed (capped or plugged) prior to shipment from the manufacturer's plant.

2.3 PIPE, FITTINGS AND END CONNECTIONS (JOINTS)

2.3.1 Steel Pipe

Steel pipe for refrigerant service must conform to ASTM A53/A53M, Schedule 40, Type E or S, Grades A or B. Do not use Type F pipe.

2.3.1.1 Welded Fittings and Connections

Butt-welded fittings must conform to ASME B16.9. Socket-welded fittings must conform to ASME B16.11. Identify welded fittings with the appropriate grade and marking symbol. Welded valves and pipe connections (both butt-welds and socket-welds types) must conform to ASME B31.9.

2.3.1.2 Threaded Fittings and Connections

Threaded fitting must conform to ASME B16.3. Threaded valves and pipe connections must conform to ASME B1.20.1.

2.3.1.3 Flanged Fittings and Connections

Flanges must conform to ASME B16.5, Class 150. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. Gaskets must contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns must conform to ASME B16.5. Bolts must be high or intermediate strength material conforming to ASTM A193/A193M.

2.3.2 Copper Tubing

Provide copper tubing conforming to ASTM B280 annealed or hard drawn as required. Copper tubing must bear the product identification markings in accordance with ASTM B280,

"ACR" must be present on copper tubing. Copper tubing must be soft annealed where bending is required and hard drawn where no bending is required. Soft annealed copper tubing must not be used in sizes larger than 1-3/8 inches. Joints must be brazed except that joints on lines 7/8 inch and smaller may be flared. Cast copper alloy fittings for flared copper tube must conform to ASME B16.26 and ASTM B62. Wrought copper and bronze solder-joint pressure fittings must conform to ASME B16.22 and ASTM B75/B75M. Joints and fittings for brazed joint must be wrought-copper or forged-brass sweat fittings. Cast sweat-type joints and fittings are not allowed for brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

2.3.3 Solder

Solder must conform to ASTM B32, grade Sb5, tin-antimony alloy for service pressures up to 150 psig. Solder flux must be liquid or paste form, non-corrosive and conform to ASTM B813.

2.3.4 Brazing Filler Metal

Filler metal must conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type FB3-A or Type FB3-C flux, except Type BCuP-3, BCuP-4, or BCuP-5 may be used for brazing copper-to-copper joints. BAlSi-4 with AWS Type FB1-A flux may be used when joining copper piping to aluminum components.

2.3.5 Brazing Flux

Brazing flux must conform to AWS A5.31/A5.31M, Type FB3-A or Type FB3-C when using Type BAg-5 filler metal. Type FB1-A is to be used with Type BAlSi-4 filler metal.

2.3.6 Press Fittings

Press fittings are not acceptable for use in refrigerant piping systems.

2.4 VALVES

Valves must be designed, manufactured, and tested specifically for refrigerant service. The valve material and all internal components must be compatible with the specific refrigerant and lubricant used. Valve bodies must be of brass, bronze, steel, or ductile iron construction. Valves 1 inch and smaller must have brazed or socket welded connections. Valves larger than 1 inch must have tongue-and-groove flanged end connections. Do not use threaded end connections, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Internal parts must be removable for inspection or replacement without applying heat or breaking pipe connections. Valve stems exposed to the atmosphere must be stainless steel or corrosion resistant metal plated carbon steel. Direction of flow must be legibly and permanently indicated on the valve body. Control valve inlets must be fitted with integral or adapted strainer or filter where recommended or required.

by the manufacturer. Purge, charge and receiver valves must be of manufacturer's standard configuration.

2.4.1 Refrigerant Stop Valves

Valve must be the globe or full-port ball type with a back-seating stem especially packed for refrigerant service. Valve packing must be replaceable under line pressure. Provide valve with a wrench operator and a seal cap. Valve must be the straight or angle pattern design as indicated.

2.4.2 Check Valves

Valve must be the swing or lift type as required to provide positive shutoff at the differential pressure indicated. Valve must be provided with resilient seat.

2.4.3 Liquid Solenoid Valves

Provide valves that comply with AHRI 760 I-P and are suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions. Valves must be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions must be furnished. Provide solenoid coils that are moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required. Valves must have safe working pressure of 610 psi and a maximum operating pressure differential of at least 200 psi at 85 percent rated voltage. Valves must have an operating pressure differential suitable for the refrigerant used.

2.4.4 Expansion Valves

Provide valve conforming to AHRI 750 I-P and ASHRAE 17. Valve must be the diaphragm and spring-loaded type with internal or external equalizers, and bulb and capillary tubing. Provide valve with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 2 degrees F of saturated suction temperature at evaporator conditions. Bulb charge must be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Do not use gas limited liquid charged valves and other valve devices for limiting evaporator pressure without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body. Pilot-operated valves must have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to close the main valve in lieu of a solenoid valve in the main liquid line. Provide an isolatable pressure gauge in the pilot line, at the main valve. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicated or for constant evaporator loads.

2.4.5 Electronic Expansion Valves

Valve must conform to AHRI 1370 I-P and ASHRAE 17. The valve must prevent the return of liquid to the compressor in the event of power loss or low superheat.

2.4.6 Safety Relief Valves

Valve must be the two-way type, unless indicated otherwise. Valve must bear the ASME code symbol. Valve capacity must be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve must be of an automatically reseating design after activation.

2.4.7 Evaporator Pressure Regulators, Direct-Acting

Valve must include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve must maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load must not exceed the pressure difference corresponding to a 2 degrees F change in saturated refrigerant temperature at evaporator operating suction temperature. Spring must be selected for indicated maximum allowable suction pressure range.

2.4.8 Refrigerant Access Valves

Provide refrigerant access valves and hose connections in accordance with AHRI 720.

2.5 PIPING ACCESSORIES

2.5.1 Filter Driers

Driers must conform to AHRI 710 I-P. Sizes 5/8 inch and larger must be the full flow, replaceable core type. Sizes 1/2 inch and smaller must be the sealed type. Cores must be of suitable desiccant that will not plug, cake, dust, channel, or break down, and must remove water, acid, and foreign material from the refrigerant. Construct filter driers so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure must be 1,500 psi.

2.5.2 Sight Glass and Liquid Level Indicator

2.5.2.1 Assembly and Components

Assembly must be pressure- and temperature-rated and constructed of materials suitable for the service. Glass must be borosilicate type. Ferrous components subject to condensation must be electro-galvanized.

2.5.2.2 Gauge Glass

Gauge glass must include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.

2.5.2.3 Bull's-Eye and Inline Sight Glass Reflex Lens

Provide bull's-eye and inline sight glass reflex lens for dead-end liquid service. For pipe line mounting, provide two plain lenses in one body suitable for backlighting viewing.

2.5.2.4 Moisture Indicator

Indicator must be a self-reversible action, moisture reactive, color changing media. Indicator must be furnished with full-color-printing tag containing color, moisture, and temperature criteria. Unless otherwise indicated, the moisture indicator must be an integral part of each corresponding sight glass.

2.5.3 Vibration Dampeners

Dampeners must be of the all-metallic bellows and woven-wire type.

2.5.4 Flexible Pipe Connectors

Connector must be a composite of interior corrugated phosphor bronze or Type 300 Series stainless steel, as required for fluid service, with exterior reinforcement of bronze, stainless steel or monel wire braid. Assembly must be constructed with a safety factor of not less than 4 at 300 degrees F. Unless otherwise indicated, the length of a flexible connector must be as recommended by the manufacturer for the service intended.

2.5.5 Strainers

Strainers used in refrigerant service must have brass or cast-iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens must be stainless steel or monel and reinforced spring-loaded where necessary for bypass-proof construction.

2.5.6 Pressure and Vacuum Gauges

Provide gauges conforming to ASME B40.100 with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge must be a minimum of 3-1/2 inches in diameter with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Select each gauge range so that at normal operating pressure, the needle is within the middle-third of the range.

2.5.7 Temperature Gauges

Provide industrial duty type temperature gauges for the required temperature range. Gauges must have Fahrenheit scale in 2 degrees graduations scale (black numbers) on a white face. The pointer must be adjustable. Provide rigid stem type temperature gauges in thermowells located within 5 feet of the finished floor. Provide universal adjustable angle type or remote element type temperature gauges in thermowells located 5 to 7 feet above the finished floor. Provide remote element type temperature gauges in thermowells located 7 feet above the finished floor.

2.5.7.1 Stem Cased-Glass

Provide stem cased-glass case composed of polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.5.7.2 Bimetallic Dial

Provide bimetallic dial type case that is greater than 3-1/2 inches, stainless steel, and hermetically sealed with clear acrylic lens. Bimetallic element must be silicone dampened and unit fitted with external calibrator adjustment. Accuracy must be one percent of dial range.

2.5.7.3 Liquid-, Solid-, and Vapor-Filled Dial

Provide liquid-, solid-, and vapor-filled dial type cases that are greater than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill must be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing must be double-braided bronze.

2.5.7.4 Thermowell

Thermowell must be identical size, 1/2 or 3/4 inch NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury must not be used in thermometers. Extended neck thermowells must be of sufficient length to clear insulation thickness by 1 inch.

2.5.8 Pipe Hangers, Inserts, and Supports

Provide pipe hangers, inserts, guides, and supports conforming to MSS SP-58.

2.5.9 Escutcheons

Escutcheons must be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.6 FABRICATION

2.6.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, must be factory finished with the manufacturer's standard finish.

2.6.2 Factory Applied Insulation

Factory installed insulation must be in accordance with ASHRAE 90.1 - IP. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes must be determined by ASTM E84. Test insulation in the same density and installed thickness as the material to be used in the actual construction. Test material supplied by a manufacturer with a jacket as a composite material. Provide jackets, facings, and adhesives that have a flame spread index less than 25 and a smoke developed index less than 50 when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, perform a verification of dimensions in the field.

3.2 INSTALLATION

Pipe and fitting installation must conform to the requirements of ASME B31.1. Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation is not permitted without written approval. Cut pipe or tubing square, remove by reaming, and permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

3.2.1 Directional Changes

Make changes in direction with fittings, except that bending of pipe 4 inches and smaller is permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends must not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.

3.2.2 Functional Requirements

Install piping 1/2 inch/10 feet of pipe in the direction of flow to ensure adequate oil drainage. Properly cap or plug open ends of refrigerant lines or equipment during installation to keep moisture, dirt, or other foreign material out of the system. Piping must remain capped until installation. Equipment piping must be in accordance with the equipment manufacturer's recommendations and the contract drawings. Equipment and piping arrangements must fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

3.2.3 Fittings and End Connections

3.2.3.1 Threaded Connections

Make threaded connections with tapered threads and make tight with PTFE tape complying with ASTM D3308 or equivalent thread-joint compound applied to the male threads only. Do not show more than three threads after the joint is made.

3.2.3.2 Brazed Connections

Perform brazing in accordance with AWS BRH, except as modified herein. During brazing, fill the pipe and fittings with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, clean both the outside of the tube and the inside of the fitting with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux on copper-to-copper connections. Remove surplus brazing material at all joints. Make steel tubing joints in accordance with the manufacturer's recommendations. Paint joints in steel tubing with the same material as the baked-on coating within 8 hours after joints are made. Protect tubing against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Support piping prior to brazing and do not spring or force.

3.2.3.3 Welded Connections

Fusion-weld joints in steel refrigerant piping. Make branch connections with welding tees or forged welding branch outlets. Thoroughly clean pipe of all scale and foreign matter before the piping is assembled. During welding, fill the pipe and fittings with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld must conform to ASME B31.1. Remove and reweld weld defects at no additional cost to the Government. Store and dry electrodes in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Do not use electrodes that have been wetted or that have lost any of their coating

3.2.3.4 Flared Connections

When flared connections are used, use a suitable lubricant between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.2.3.5 Flanged Connections

When steel refrigerant piping is used, provide union or flange joints in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, chillers, control valves, and other similar items. Flanged joints must be assembled square end tight with matched flanges, gaskets, and bolts. Provide gaskets that are suitable for use with the refrigerants to be handled.

3.2.4 Valves

3.2.4.1 General

Install refrigerant stop valves on each side of each piece of equipment such as compressors, condensers, evaporators, receivers, and other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Install stop valves with stems horizontal unless otherwise indicated. Install ball valves must be installed with stems positioned to facilitate operation and maintenance. Isolating valves for pressure gauges and switches must be external to thermal insulation. Safety switches must not be fitted with isolation valves. Filter dryers having access ports may be considered a point of isolation. Purge valves must be provided at all points of systems where accumulated non-condensable gases would prevent proper system operation. Valves must be furnished to match line size, unless otherwise indicated or approved.

3.2.4.2 Expansion Valves

Install expansion valves with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than 2-1/8 inches in diameter and at the 4 o'clock or 8 o'clock position on lines larger than 2-1/8 inches. Fasten the bulb securely with two clamps. Insulate the bulb. Install the bulb in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing must be facing up.

3.2.4.3 Valve Identification

Tag each system valve, including those which are part of a factory assembly. Tags must be in alphanumeric sequence, progressing in direction of fluid flow. Tags must be embossed, engraved, or stamped plastic or nonferrous metal of various shapes, sized approximately 1-3/8 inch diameter, or equivalent dimension, substantially attached to a component or immediately adjacent thereto. Attach tags with nonferrous, heavy duty, bead or link chain, 14 gauge annealed wire, nylon cable bands or as approved. Reference tag numbers in Operation and Maintenance Manuals and system diagrams.

3.2.5 Vibration Dampers

Provide vibration damper in the suction and discharge lines on spring mounted compressors. Install vibration dampers parallel with the shaft of the compressor and anchor firmly at the upstream end on the suction line and the downstream end in the discharge line.

3.2.6 Strainers

Provide strainers immediately ahead of solenoid valves and expansion devices. Strainers may be an integral part of an expansion valve.

3.2.7 Filter Dryer

Provide a liquid line filter dryer on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. Size dryers in accordance with the manufacturer's recommendations for the system in which it is installed. Install dryers such that it can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Install dryers in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

3.2.8 Sight Glass

Install a moisture indicating sight glass in all refrigerant circuits down stream of all filter dryers and where indicated. Provide full line size sight glasses.

3.2.9 Discharge Line Oil Separator

Provide discharge line oil separator in the discharge line from each compressor. Connect the oil return line to the compressor as recommended by the compressor manufacturer.

3.2.10 Accumulator

Provide accumulators in the suction line to each compressor.

3.2.11 Flexible Pipe Connectors

Install connectors perpendicular to line of motion being isolated. Fit piping for equipment with bidirectional motion with two flexible connectors, in perpendicular planes. Install reinforced elastomer flexible connectors in accordance with manufacturer's instructions. Provide piping guides and restraints related to flexible connectors as required.

3.2.12 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports must conform to MSS SP-58, except as modified herein. Do not use pipe hanger types 5, 12, and 26. Fabricate hangers used to support piping 2 inches and larger to permit adequate adjustment after erection while still supporting the load. Support

piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, by variable spring hangers and supports or by constant support hangers.

3.2.12.1 Hangers

Do not use Type 3 on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.2.12.2 Inserts

Secure Type 18 inserts to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

3.2.12.3 C-Clamps

Torque Type 19 and 23 C-clamps in accordance with MSS SP-58 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.2.12.4 Angle Attachments

Furnish Type 20 attachments used on angles and channels with an added malleable-iron heel plate or adapter.

3.2.12.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, must be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Use Type 40 shields on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. Use a high-density insulation insert of cellular glass under the Type 40 shield for piping 2 inches and larger.

3.2.12.6 Horizontal Pipe Supports

Space horizontal pipe supports as specified in MSS SP-58 and install a support no more than 1 foot from the pipe fitting joint at each change in direction of the piping. Space pipe supports no more than 5 feet apart at valves.

3.2.12.7 Vertical Pipe Supports

Support vertical pipe at each floor, except at slab-on-grade, and at intervals of not more than 15 feet not more than 8 feet from end of risers, and at vent terminations.

3.2.12.8 Pipe Guides

Provide Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides where required to allow longitudinal pipe movement. Provide lateral restraints as required. Provide slide materials that are suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.2.12.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, use a Type 39 saddle. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

3.2.12.10 High Temperature Guides with Cradles

Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide must include a pipe cradle, welded to the guide structure and strapped securely to the pipe. Separate the pipe from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

3.2.12.11 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, use a clip or clamp where each pipe crosses the base support member. Spacing of the base support members must not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.2.12.12 Structural Attachments

Attachment to building structure concrete and masonry must be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors must be applied with a safety factor not less than 5. Do not attach supports to metal decking. Construct masonry anchors for overhead applications of ferrous materials only. Provide structural steel brackets required to support piping, headers, and equipment, but not shown, under this section.

3.2.13 Pipe Alignment Guides

Provide pipe alignment guides where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.2.14 Pipe Anchors

Provide anchors wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Provide anchors consisting of heavy steel collars with lugs and bolts for

clamping and attaching anchor braces, unless otherwise indicated. Install anchor braces in the most effective manner to secure the desired results using turnbuckles where required. Do not attach supports, anchors, or stays where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, immediately anchor these items adjacent to each penetrated surface, to provide essentially zero movement within penetration seal. Submit detailed drawings of pipe anchors for approval before installation.

3.2.15 Building Surface Penetrations

Do not install sleeves in structural members except where indicated or approved. Provide galvanized sheet metal sleeves in non-load bearing surfaces conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Provide uncoated carbon steel pipe sleeves in load bearing surfaces conforming to ASTM A53/A53M, Schedule 40. Apply sealants to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Do not install sleeves in structural members.

3.2.15.1 General Service Areas

Extend each sleeve through its respective wall, floor, or roof, and cut flush with each surface. Provide pipes passing through concrete or masonry wall or concrete floors or roofs with pipe sleeves fitted into place at the time of construction. Provide sleeves that allow a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, seal the annular space between pipe and sleeve or between jacket over-insulation and sleeve in accordance with Section 07 92 00 JOINT SEALANTS.

3.2.15.2 Waterproof Penetrations

Install pipes passing through roof or floor waterproofing membrane through a 17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange. Form flashing sleeve, and extend skirt or flange greater than 8 inches from the pipe and set over the roof or floor membrane in a troweled coating of bituminous cement. Extend the flashing sleeve up the pipe a minimum of 2 inches above the roof or floor penetration. Seal the annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation as indicated. Seal penetrations by either one of the following methods.

3.2.15.2.1 Waterproofing Clamping Flange

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. Clamp waterproofing membrane into place and place sealant in the caulking recess.

3.2.15.2.2 Modular Mechanical Type Sealing Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Provide seals consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Loosely assemble links 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, tighten the bolt to cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Size each seal assembly as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals must provide sleeves of the proper diameters.

3.2.15.3 Escutcheons

Provide escutcheons for finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Where sleeves project slightly from floors, use special deep-type escutcheons. Secure escutcheon to pipe or pipe covering.

3.2.16 Access Panels

Provide access panels for all concealed valves, vents, controls, and items requiring inspection or maintenance. Provide access panels of sufficient size and locate so that the concealed items may be serviced and maintained or completely removed and replaced.

3.2.17 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.2.17.1 Color Coding

Color coding for piping identification is specified in Section 09 90 00 PAINTS AND COATINGS.

3.3 CLEANING AND ADJUSTING

Clean uncontaminated system(s) by evacuation and purging procedures currently recommended by refrigerant and refrigerant equipment manufacturers, and as specified herein, to remove small amounts of air and moisture. Systems containing moderate amounts of air, moisture, contaminated refrigerant, or any foreign matter are considered contaminated systems. Restore contaminated systems to clean condition including disassembly, component replacement, evacuation, flushing, purging, and re-charging, using currently approved refrigerant and refrigeration manufacturer's procedures. Restore contaminated systems at no

additional cost to the Government as determined by the Contracting Officer. Do not use water in any procedure or test.

3.4 REFRIGERANT PIPING TESTS

After all components of the refrigerant system have been installed and connected, subject the entire refrigeration system to pneumatic, evacuation, and startup tests as described herein. Submit a schedule, at least 2 weeks prior to the start of related testing, for each test. Identify the proposed date, time, and location for each test. Conduct tests in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Provide all material, equipment, instruments, and personnel required for the test. Provide the services of a qualified technician, as required, to perform all tests and procedures indicated herein. Submit 3 copies of the tests report in bound 8 1/2 by 11 inch booklets documenting all phases of the tests performed. Include initial test summaries, all repairs/adjustments made, and the final test results in the report.

3.4.1 Preliminary Procedures

Prior to pneumatic testing, isolate equipment which has been factory tested and refrigerant charged as well as equipment which could be damaged or cause personnel injury by imposed test pressure, positive or negative, from the test pressure, or remove from the system. Remove safety relief valves and rupture discs that are not part of factory sealed systems, and cap or plug openings.

3.4.2 Pneumatic Test

Provide pressure control and excess pressure protection at the source of test pressure. Valves must be wide open, except those leading to the atmosphere. Test gas must be dry nitrogen, with minus 70 degree F dewpoint and less than 5 ppm oil. Apply test pressure in two stages before any refrigerant pipe is insulated or covered. In accordance with ASME B31.5, a preliminary test not to exceed 25 psi must be applied as a means of locating major leaks. Every joint being tested must be coated with a thick soap or color indicating solution. The second stage test pressure must be at least 110 percent of the design pressure, but cannot exceed 130 percent of the design pressure of any component in the system. For large systems that are not completely visible, the pressure in the system must be gradually increased to one-half of the test pressure after which the pressure must be increased in steps of one-tenth of the test pressure, until the required test pressure has been reached. The test pressure must be continuously maintained for at least 24 hours, after which it can be reduced to the leak test pressure. A correction factor of 0.3 psi will be allowed for each degree F change between test space initial and final ambient temperature, plus for increase and minus for a decrease. The leak test pressure must be the design pressure, or a pressure specified in the engineering design. To repair leaks, the joint must be taken apart, thoroughly cleaned, and reconstructed as a new joint. Joints repaired by caulking, re-melting, or back-welding/brazing are not acceptable. Following repair, the entire system must be retested using the pneumatic tests described above. Reassemble the entire system once the pneumatic tests are satisfactorily completed.

3.4.3 Evacuation Test

Following satisfactory completion of the pneumatic tests, relieve the pressure and evacuate the entire system to an absolute pressure of 300 micrometers. During evacuation of the system, the ambient temperature must be higher than 35 degrees F. Do not evacuate no more than one system at one time by one vacuum pump. Once the desired vacuum has been reached, close the vacuum line and allow the system to stand for 1 hour. If the pressure rises over 500 micrometers after the 1 hour period, evacuate the system again down to 300 micrometers and let set for another 1 hour period. Do not charge the system until a vacuum of at least 500 micrometers is maintained for a period of 1 hour without the assistance of a vacuum line. If during the testing the pressure rises above 500 micrometers, continue to repeat the evacuation procedures until all residual moisture has been removed. During evacuation, record pressures by a thermocouple-type, electronic-type, or a calibrated-micrometer type gauge.

3.4.4 System Charging and Startup Test

Following satisfactory completion of the evacuation tests, charge the system with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system must operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. Test the entire system tested for leaks. Test fluorocarbon systems with halide torch or electronic leak detectors.

3.4.5 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system must be immediately isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. The refrigerant must not be discharged into the atmosphere.

3.4.6 Contractor's Responsibility

At all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps must include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time will the allowable leak rate exceed the leak rates allowed in Section 608 of the Clean Air Act: 30 percent of the full charge per year for industrial refrigeration, 20 percent of the full charge per year for commercial refrigeration, and 10 percent of the full charge per year for comfort cooling. Any system leaks within the first year must be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

END OF SECTION

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SECTION 23 81 00 - DECENTRALIZED UNITARY HVAC EQUIPMENT

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 700 (2016) Specifications for Fluorocarbon Refrigerants

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR- CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15 & 34 (2013) ASHRAE Standard 34-2016 Safety Standard for Refrigeration Systems/ASHRAE Standard 34-2016 Designation and Safety Classification of Refrigerants-ASHRAE Standard 34-2016

ASHRAE 52.2 (2012) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASHRAE 55 (2010) Thermal Environmental Conditions for Human Occupancy

ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality

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 MECHANICAL ENGINEERS (ASME)

ASME BPVC SEC IX (2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

ASME BPVC SEC VIII D1 (2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (2021) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D520 (2000; R 2011) Zinc Dust Pigment

ASTM E84 (2020) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2018) Motors and Generators

NEMA MG 2 (2014) Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

UL 900 (2015) Standard for Air Filter Units

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-03 Product Data

Spare Parts

Posted Instructions

System Performance Tests

Training; G

Inventory

Supplied Products

Manufacturer's Standard Catalog Data

SD-06 Test Reports

Refrigerant Tests, Charging, and Start-Up; G

System Performance Tests; G

SD-07 Certificates

Service Organizations

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

Ozone Depleting Substances;

1.3 QUALITY ASSURANCE

Carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions. Submit drawings consisting of:

- a. Equipment layouts which identify assembly and installation details.
- b. Plans and elevations which identify clearances required for maintenance and operation.
- c. Wiring diagrams which identify each component individually and interconnected or interlocked relationships between components.

- d. Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for equipment indicated or required to have concrete foundations.
- e. Details, if piping and equipment are to be supported other than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.
- f. Automatic temperature control diagrams and control sequences.
- g. Installation details which includes the amount of factory set superheat and corresponding refrigerant pressure/temperature.
- h. Equipment schedules

1.4 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Properly protect and care for all material both before and during installation. Submit an inventory of all the stored items. Replace any materials found to be damaged, at no additional cost to the Government. During installation, cap piping and similar openings capped to keep out dirt and other foreign matter.

1.5 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain pressure within the building as indicated. Ventilation must meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort must meet or exceed ASHRAE 55.

1.6 WARRANTY

Provide equipment with the 1 year manufacturer's warranty.

PART 2 PRODUCTS

2.1 ENERGY EFFICIENCY REQUIREMENTS

42 USC 8259b requires the procurement of energy efficient products in product categories covered by the Energy Star program or the Federal Energy Management Program for designated products. A list of covered product categories is available from the Federal Energy Management Web site at <http://energy.gov/eere/femp/covered-product-categories>.

Submit Material, Equipment, and Fixtures List of all supplied products within a covered product category, including manufacturer's catalog numbers, specification and drawing reference number, warranty information, fabrication site, and energy performance data. For

product categories covered by the Federal Energy Management Program, submit documentation that the product meets or exceeds FEMP-designated efficiency requirements.

2.2 MATERIALS

Provide Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data includes manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, include vibration isolator literature containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations. Submit data for each specified component. Minimum efficiency requirements must be in accordance with ASHRAE 90.1 - IP.

2.2.1 Standard Products

Provide materials and equipment that are standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use includes applications of equipment and materials under similar circumstances and of similar size. The 2 years' experience 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 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 manufacturer's factory tests, can be shown. Products must be supported by a service organization. Ensure system components are environmentally suitable for the indicated geographic locations.

2.2.2 Product Sustainability Criteria

2.2.2.1 Energy Efficient Equipment

Provide equipment meeting the efficiency requirements as stated within this section and provide documentation.

2.2.2.2 Electrical Equipment / Motors

Provide electrical equipment, motors, motor efficiencies, and wiring which are in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical motor driven equipment specified must be provided complete with motors, motor starters, and controls. Electrical characteristics must be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, must be the premium efficiency type in accordance with NEMA MG 1. Field wiring must be in accordance with manufacturer's instructions. Each motor must conform to

NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors must be continuous duty with the enclosure specified. Motor starters must be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors must be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors must be sized for the applicable loads. Motor torque must 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 must be fitted with grease supply fittings and grease relief to outside of enclosure. 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, must be provided.

2.2.2.3 Ozone Depleting Substances

Unitary air conditioning equipment must not use CFC-based refrigerants. Refrigerant may be an approved alternative refrigerant in accordance with EPA's Significant New Alternative Policy (SNAP) listing. Provide documentation.

2.2.2.4 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.

2.2.3 Nameplates

Major equipment including compressors, condensers, receivers, heat exchanges, fans, and motors must have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates must be durable and legible throughout equipment life and made of anodized aluminum. Fix plates in prominent locations with nonferrous screws or bolts.

2.2.4 Safety Devices

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices must be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements must be in accordance with AWS Z49.1.

2.3 COMPONENTS

2.3.1 Refrigerant and Oil

Refrigerant must be one of the fluorocarbon gases. Refrigerants must have number designations and safety classifications in accordance with ASHRAE 15 & 34. Refrigerants must meet the requirements of AHRI 700 as a minimum. Provide a complete charge of refrigerant for the installed system as recommended by the manufacturer. Lubricating oil must be of a type and grade recommended by the manufacturer for each compressor. Where color leak indicator dye is incorporated, charge must be in accordance with manufacturer's recommendation.

2.3.2 Fans

Unit fans must be selected to produce the cfm required at the fan total pressure. Motor starters, if applicable, must be magnetic across-the-line type with an open dripproof enclosure. Thermal overload protection must be of the manual or automatic-reset type. Centrifugal fan wheel housings must be of galvanized steel, and both centrifugal and propeller fan casings must be constructed of aluminum or galvanized steel. Steel elements of fans, except fan shafts, must be hot-dipped galvanized after fabrication or fabricated of mill galvanized steel. Mill-galvanized steel surfaces and edges damaged or cut during fabrication by forming, punching, drilling, welding, or cutting must be recoated with an approved zinc-rich compound. Fan wheels or propellers must be statically and dynamically balanced. Direct-drive fan motors must be of the multiple-speed variety.

2.3.3 Air Filters

Provide replaceable (throw-away) type. Filters must conform to UL 900, Class 1. Polyurethane filters cannot be used on units with multiframe filters.

Air filters must be listed in accordance with requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test Method must be as listed under the label service and must meet the requirements of UL 586.

2.3.4 Cabinet Construction

Casings for the specified unitary equipment must be constructed of galvanized steel or aluminum sheet metal and galvanized or aluminum structural members.

2.3.4.1 Outdoor Cabinet

Outdoor cabinets must be suitable for outdoor service with a weathertight, insulated and corrosion-protected structure. Cabinets constructed exclusively for indoor service which have been modified for outdoor service are not acceptable.

2.3.5 Refrigerant Piping

Provide refrigerant piping in accordance with Section 23 23 00 REFRIGERANT PIPING. Refrigerant piping shall be insulated and jacketed where exposed to outdoors. .

2.3.6 Condensate Drain Piping

Provide insulated copper condensate drain piping. Spill on grade. Exterior piping shall be jacketed with an aluminum jacket.

2.4 FINISHES

2.4.1 Equipment and Components Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, must be factory finished with the manufacturer's standard finish, except that items located outside of buildings must have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen must show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used must be coated with a zinc-rich coating conforming to ASTM D520, Type I.

2.4.2 Factory Applied Insulation

Refrigeration equipment must be provided with factory installed insulation on surfaces subject to sweating including the suction line piping. Where motors are the gas-cooled type, factory installed insulation must be provided on the cold-gas inlet connection to the motor in accordance with manufacturer's standard practice. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors must have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes must be determined by ASTM E84. Insulation must be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket must be tested as a composite material. Jackets, facings, and adhesives must have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.

2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

All manufactured units must be inspected and tested, and documentation provided to demonstrate that each unit is in compliance with ANSI/AHRI and UL requirements and that the minimum efficiency requirements of ASHRAE 90.1 - IP have been met.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, perform Verification of Dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 INSTALLATION

Perform work in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPVC SEC VIII D1 and ASME BPVC SEC IX, the design, fabrication, and installation of the system must conform to ASME BPVC SEC VIII D1 and ASME BPVC SEC IX.

3.2.1 Equipment

Provide refrigeration equipment conforming to ASHRAE 15 & 34. Provide necessary supports for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, and similar items. Isolate compressors from the building structure. Equipment must be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.2.2 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.3 CLEANING AND ADJUSTING

Equipment must be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters must be provided for all fans that are operated during construction, and new filters must be installed after all construction dirt has been removed from the building. System must be maintained in this clean condition until final acceptance. Bearings must be properly lubricated with oil or grease as recommended by the manufacturer. Belts must be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment must be adjusted to setting indicated or directed. Fans must be adjusted to the speed indicated by the manufacturer to meet specified conditions. .

3.4 TRAINING

Conduct a training course for the operating staff as designated by the Contracting Officer. The training period must consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests.

- a. Submit a schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.
- b. Submit the field posted instructions, at least 2 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions must include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions must be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.
- c. The posted instructions must cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations. Submit 2 complete copies of an operation manual in bound 8-1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets must include the manufacturer's name, model number, and parts list. The manuals must include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.
- d. Submit 2 complete copies of maintenance manual in bound 8-1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals must include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

3.5 REFRIGERANT TESTS, CHARGING, AND START-UP

Split-system refrigerant piping systems must be tested and charged as specified in Section 23 00 REFRIGERANT PIPING. Following charging, packaged systems must be tested for leaks with a halide torch or an electronic leak detector. Submit 2 copies of each test containing the information described below in bound 8-1/2 by 11 inch booklets. Individual reports must be submitted for the refrigerant system tests.

- a. The date the tests were performed.
- b. A list of equipment used, with calibration certifications.
- c. Initial test summaries.
- d. Repairs/adjustments performed.
- e. Final test results.

3.5.1 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system must immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances must the refrigerant be discharged into the atmosphere.

3.5.2 Contractor's Responsibility

Take steps, at all times during the installation and testing of the refrigeration system, to prevent the release of refrigerants into the atmosphere. The steps must include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time must more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year must be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

3.6 SYSTEM PERFORMANCE TESTS

Before each refrigeration system is accepted, conduct tests to demonstrate the general operating characteristics of all equipment by an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Six copies of the report provided in bound 8-1/2 by 11 inch booklets. The report must document compliance with the specified performance criteria upon completion and testing of the system. The report must indicate the number of days covered by the tests and any conclusions as to the adequacy of the system.

For equipment providing heating and cooling the system performance tests must be performed during the heating and cooling seasons.

- a. Submit a schedule, at least 2 weeks prior to the start of related testing, for the system performance tests. The schedules must identify the proposed date, time, and location for each test. Tests must cover a period of not less than 48 hours for each system and must demonstrate that the entire system is functioning in accordance with the drawings and specifications.
- b. Make corrections and adjustments, as necessary, tests must be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, install and tighten service valve seal caps and blanks over gauge points. Replace any refrigerant lost during the system startup.
- c. If tests do not demonstrate satisfactory system performance, correct deficiencies and retest the system. Conduct tests in the presence of the Contracting Officer. Water and

electricity required for the tests will be furnished by the Government. Provide all material, equipment, instruments, and personnel required for the test.

- d. Submit 2 copies of the report provided in bound 8-1/2 by 11 inch booklets. The report must document compliance with the specified performance criteria upon completion and testing of the system. The report must indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. Submit the report including the following information (where values are taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart):

- (1) Date and outside weather conditions.
- (2) The load on the system based on the following:
 - (a) The refrigerant used in the system.
 - (b) Condensing temperature and pressure.
 - (c) Suction temperature and pressure.
 - (d) Ambient, condensing and coolant temperatures.
 - (e) Running current, voltage and proper phase sequence for each phase of all motors.
- (3) The actual on-site setting of operating and safety controls.
- (4) Thermostatic expansion valve superheat - value as determined by field test.
- (5) Subcooling.
- (6) High and low refrigerant temperature switch set-points
- (7) Low oil pressure switch set-point.
- (8) Defrost system timer and thermostat set-points.
- (9) Moisture content.
- (10) Capacity control set-points.
- (11) Field data and adjustments which affect unit performance and energy consumption.
- (12) Field adjustments and settings which were not permanently marked as an integral part of a device.

3.7 MAINTENANCE

3.7.1 EXTRA MATERIALS

Submit spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 2 months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

3.7.2 Maintenance Service

Submit a certified list of qualified permanent service organizations, which includes their addresses and qualifications, for support of the equipment. The service organizations must be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

END OF SECTION

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SECTION 26 0518 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices for electrical components.
 - 2. Electrical identification.
 - 3. Concrete equipment bases.
 - 4. Electrical demolition.
 - 5. Cutting and patching for electrical construction.
 - 6. Touchup painting.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
1. Channel Thickness: Selected to suit structural loading.
 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.

- I. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend that indicates type of underground line.
- C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with pre-printed numbers and letters.
- D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- F. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- G. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.
- H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.4 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.

- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 3/4-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate **6 to 8 inches (150 to 200 mm)** below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed **16 inches (400 mm)**, overall, use a single line marker.

- F. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.6 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. The firestopping shall be made in accordance with a UL listed assembly.

3.7 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.8 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.9 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.10 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Supporting devices for electrical components.
 - 2. Electrical identification.
 - 3. Concrete bases.
 - 4. Electrical demolition.
 - 5. Cutting and patching for electrical construction.
 - 6. Touchup painting.

3.11 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint.
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 0518

SECTION 26 0519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Rubber Insulation Material: Comply with NEMA WC 3.
- C. Thermoplastic Insulation Material: Comply with NEMA WC 5.
- D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- F. Conductor Material: Copper.
- G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.2 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

- A. Service Entrance: Type RHW or THWN, in raceway.
- B. Feeders: Type THHN/THWN, in raceway.
- C. Branch Circuits: Type THHN/THWN, in raceway.
- D. Fire Alarm Circuits: Type THHN/THWN, in raceway.

- E. Class 1 Control Circuits: Type THHN/THWN, in raceway.
- F. Class 2 Control Circuits: Type THHN/THWN, in raceway.

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Remove existing wires from raceway before pulling in new wires and cables.
- C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."
- G. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."
- H. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Grounding Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- E. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- F. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
- G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

- D. **Air-Duct Equipment Circuits:** Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- E. **Water Heater, Heat-Tracing, and Antifrost Heating Cables:** Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 INSTALLATION

- A. **Grounding Conductors:** Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. **Bonding Straps and Jumpers:** Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.4 CONNECTIONS

- A. **General:** Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. **Exothermic-Welded Connections:** Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. **Equipment Grounding Conductor Terminations:** For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. **Noncontact Metal Raceway Terminations:** If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - 2. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

SECTION 26 0533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. Raceways include the following:
 - a. RMC.
 - b. IMC.
 - c. EMT.
 - d. FMC.
 - e. LFMC.
 - f. LFNC.
 - g. RNC.
 - 2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping."
 - 2. Division 26 Section "Basic Electrical Materials and Methods" for raceways and box supports.
 - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.

- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RMC: Rigid metal conduit.
- H. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- D. Plastic-Coated IMC and Fittings: NEMA RN 1.
- E. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Compression type.

- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
- B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
- C. LFNC: UL 1660.

2.3 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.4 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: Rigid steel or IMC.

3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 3R.

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 3/4-inch trade size (DN16).
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least **1-inch (25-mm)** concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than **1-inch trade size (DN27)** parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to rigid steel conduit before rising above floor.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of the pull wire.
- S. Flexible Connections: Use maximum of **6 feet (1830 mm)** of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- T. Do not install aluminum conduits embedded in or in contact with concrete.
- U. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- V. All PVC conduit runs shall have rigid galvanized steel 90's and rigid stub ups.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 0533

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Heavy-Duty grade, 20A.
- B. GFCI Receptacles: Termination type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle. Design units for installation in a ~~2-3/4-inch-~~ (70-mm-) deep outlet box without an adapter.
- C. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.2 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.3 SWITCHES

- A. Snap Switches: Heavy-duty, quiet type.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.
 - 1. Control: Continuously adjustable slide. Single-pole or three-way switch to suit connections.
 - 2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and ~~5-inch~~ (130-mm) wire connecting leads.
 - 3. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.

2.4 WALL PLATES

- A. Single and combination types match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: ~~0.04-inch~~ (1-mm-) thick, Type 302, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.

2.5 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

2.6 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box unit with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 1. Size: Selected to fit nominal ~~3-inch~~ (75-mm) cored holes in floor and matched to floor thickness.
 2. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 3. Closure Plug: Arranged to close unused ~~3-inch~~ (75-mm) cored openings and reestablish fire rating of floor.

2.7 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.

2.8 FINISHES

- A. Color: Gray, unless otherwise indicated or required by Code.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- F. Protect devices and assemblies during painting.
- G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods."
 - 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

- C. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

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SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Fuses.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Main Service: Class L, fast acting.
- B. Main Feeders: Class J, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

3.4 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION 26 2813

SECTION 26 2816 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes individually mounted switches used for the following:
 - 1. Feeder and equipment disconnect switches.
 - 2. Motor disconnect switches.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Fuses" for fuses in fusible disconnect switches.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for disconnect switches and accessories specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain disconnect switches from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.
- C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches level and plumb.
- C. Connect disconnect switches and components to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Identify each disconnect switch according to requirements specified in Division 16 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 2816

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SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - 3. Emergency lighting unit battery and charger.
 - 4. Fluorescent and high-intensity-discharge ballasts.
 - 5. Types of lamps.

1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last four years.
- C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.
 - 2. Special Warranty Period for Electromagnetic Ballasts: Manufacturers' standard warranty, but not less than two years from date of manufacture.
- D. Warranties for LED fixtures: All LED fixtures shall have a 10 year warranty that includes on-site replacement and covers the luminaires finish, power unit and LED's. On-site replacement shall include transportation, removal, and installation of new products.
 - 1. The LED manufacturer shall provide a written ten-year on-site replacement "finish" warranty for luminaires. Finish warranty shall include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading
 - 2. The LED manufacturer shall provide a written ten-year on-site replacement warranty for defective or non-starting power supply units and LED source assemblies, which include, but are not limited to, LED packages, LED arrays, LED modules, LED dies, encapsulates, and phosphors.
 - 3. The LED manufacturer shall provide a written ten-year on-site replacement warranty for any LED source assembly, package, array, or module, which does not include the power supply, against 10% or more of the individual LEDs in that assembly, package, array, or module failing to illuminate.

4. The LED manufacturer warranty period shall begin on the date of final acceptance, as executed by a DD Form 1354. The contractor will provide the contracting officer with the signed warranty certificates prior to final payment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedule on the drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 2. Lens Thickness: **0.15 inch** minimum, unless greater thickness is indicated.

2.3 FLUORESCENT LAMP BALLASTS

- A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output.
 2. Total Harmonic Distortion Rating: Less than 20 percent.
 3. Sound Rating: A.
- B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:
1. Certified Ballast Manufacturer Certification: Indicated by label.
 2. Encapsulation: Without voids in potting compound.
 3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:
1. Type: Electronic, fully encapsulated in potting compound.
 2. Power Factor: 90 percent, minimum.
 3. Operating Frequency: 20 kHz or higher.
 4. Flicker: Less than 5 percent.
 5. Lamp Current Crest Factor: Less than 1.7.
 6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- D. Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:
1. Power Factor: 90 percent, minimum.
 2. Ballast Coil Temperature: 65 deg C, maximum.
 3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
 4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- E. Ballasts for Low-Temperature Environments: As follows:

1. Temperatures **0 Deg F (Minus 17 Deg C)** and Above: Electronic type rated for **0 deg F (minus 17 deg C)** starting temperature.
 2. Temperatures **Minus 20 Deg F (Minus 29 Deg C)** and Above: Electromagnetic type designed for use with high-output lamps.
- F. Ballasts for Low Electromagnetic Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for consumer equipment.

2.4 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

- A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:
1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
 2. Operating Voltage: Match system voltage.
 3. Minimum Starting Temperature: **Minus 22 deg F (Minus 30 deg C)** for single lamp ballasts.
 4. Normal Ambient Operating Temperature: **104 deg F (40 deg C)**.
 5. Open-circuit operation that will not reduce average life.
 6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.
- B. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

2.5 EXIT SIGNS

- A. General Requirements: Comply with UL 924 and the following:
1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
- B. Internally Lighted Signs: As follows:
1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.6 EMERGENCY LIGHTING UNITS

- A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
 - 1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
 - 4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
 - 5. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.7 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
 - 1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
 - 3. Charger: Fully automatic, solid-state, constant-current type.

4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

2.8 LAMPS

- A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.
- B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.
- C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

2.9 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.10 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

3.2 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.

- C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- D. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 5100

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SECTION 28 31 60 - INTERIOR FIRE ALARM SYSTEM, NON-ADDRESSABLE

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.

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 4 (2018) Standard for Integrated Fire Protection and Life Safety System Testing

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 170 (2021) Standard for Fire Safety and Emergency Symbols

UNDERWRITERS LABORATORIES (UL)

UL 464 (2016; Reprint Sep 2017) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1638 (2016; Reprint Sep 2017) UL Standard for Safety Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL 1971 (2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 SUMMARY

1.2.1 Scope

- a. This work includes designing and modifying the existing fire alarm system as described herein and on the contract drawings. Include system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, initiating devices, notification appliances, supervising station fire alarm transmitters, and other accessories and miscellaneous items required for a complete operational system even though each item is not specifically mentioned or described. Provide systems complete and ready for operation. Existing interior fire alarm system manufacturer shall be verified by the contractor. All new devices shall be compatible with the existing system.
- b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with NFPA 72, except as modified herein. The system layout on the drawings show the intent of coverage and suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor.

1.2.2 Qualified Fire Protection Engineer (QFPE)

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. Construction (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. Providing a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting any outstanding comments.
- c. Signing applicable certificates under SD-07.

1.3 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions must be defined as follows:

1.3.1 Terminal Cabinet

A steel cabinet with locking, hinge-mounted door where terminal strips are securely mounted inside the cabinet.

1.3.2 Designated Fire Protection Engineer (DFPE)

The DoD fire protection engineer that oversees that Area of Responsibility for that project. This is sometimes referred to as the "cognizant" fire protection engineer. Interpret reference to "authority having jurisdiction" and/or AHJ in referenced standards to mean the Designated Fire Protection Engineer (DFPE). The DFPE may be responsible for review of the contractor submittals having a "G" designation, and for witnessing final inspection and testing.

1.3.3 Qualified Fire Protection Engineer (QFPE)

A QFPE is 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.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the fire alarm 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 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 registered professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE will be returned by the Government 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

Fire alarm system designer; G

Supervisor; G

Technician; G

Installer; G

Test Technician; G

SD-02 Shop Drawings

Wiring Diagrams; G

System Layout; G

Notification Appliances; G

Initiating devices; G

Battery Power; G

Voltage Drop Calculations; G

SD-03 Product Data

Manual Stations; G

Back Boxes and Conduit; 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

Operation and Maintenance (O&M) Instructions; G

SD-11 Closeout Submittals

As-Built Drawings

1.5 SYSTEM OPERATION

1.5.1 Alarm Initiating Devices and Notification Appliances (Visual, Audible)

- a. Connect alarm initiating devices to initiating device circuits (IDC) to match existing wiring installation (Class "A" or Class "B") and installed in accordance with NFPA 72.

- b. Connect notification appliances to notification appliance circuits (NAC) to match existing wiring installation (Class "A" or Class "B").

1.6 EXISTING EQUIPMENT

- b. Equipment and devices must be compatible and operable with the existing building fire alarm system. Equipment must not impair reliability or operational functions of the existing system.

1.7 QUALITY ASSURANCE

1.7.1 Submittal Documents

1.7.1.1 Preconstruction Submittals

Within 36 days of contract award but not less than 14 days prior to commencing any work on site, the 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 of the fire alarm subcontractor and QFPE must be returned disapproved without review. All resultant delays must be the sole responsibility of the Contractor.

1.7.1.2 Shop Drawings

Shop drawings must not be smaller than the Contract Drawings. Drawings must comply with the requirements of NFPA 72 and NFPA 170. Minimum scale for floor plans must be 1/8"=1'.

1.7.1.3 Wiring Diagrams

Two copies of 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 must show connections from field devices to the FACU and remote FACU, initiating circuits, switches, relays and terminals, including pathway diagrams between the control unit and shared communications equipment within the protected premises. Point-to-point wiring diagrams must be job specific and must not indicate connections or circuits not being utilized. Provide complete riser diagrams indicating the wiring sequence of all devices and their connections to the control equipment. Include a color-code schedule for the wiring.

1.7.1.4 System Layout

Two copies of plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, conduit fill calculations, wire color-coding, circuit identification in each conduit, and circuit layouts for all floors. Indicate candela rating of each visual notification appliance. Indicate the

addresses of all devices, modules, relays, and similar. Indicate if the environment for the FACU is within its environmental listing (e.g. temperature/humidity).

Provide a complete description of the system operation in matrix format similar to the "Typical Input/Output Matrix" included in the Annex of NFPA 72.

1.7.1.5 Notification Appliances

Calculations and supporting data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances. Annotate data for each circuit on the drawings.

1.7.1.6 Initiating Devices

Calculations and supporting data on each circuit to indicate that there is at least 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.

1.7.1.7 Battery Power

Calculations and supporting data as required in paragraph Battery Power Calculations for alarm, alert, and supervisory power requirements. Calculations including ampere-hour requirements for each system component and each control unit component, and the battery recharging period, must be included on the drawings.

1.7.1.8 Voltage Drop Calculations

Voltage drop calculations for each notification circuit indicating that sufficient voltage is available for proper operation of the system and all components, at a minimum rated voltage of the system operating on batteries. Include the calculations on the system layout drawings.

1.7.1.9 Product Data

Two copies of annotated descriptive 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, and options 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.

Provide an equipment list identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. The equipment list must include the type, quantity, make and model of spare equipment. Types and quantities of equipment submitted must coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings.

1.7.1.10 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 Government test of the system. At least one set of the as-built (marked-up) drawings must be provided at the time of, or prior to the final Government test.

1.7.2 Qualifications

1.7.2.1 Fire Alarm System Designer

The fire alarm system designer must be certified as a Level III (minimum) Technician by National Institute for Certification in Engineering Technologies (NICET) in the Fire Alarm Systems subfield of Fire Protection Engineering Technology or meet the qualifications for a QFPE.

1.7.2.2 Supervisor

A fire alarm technician with a minimum of eight years of experience must supervise the installation of the fire alarm system. The fire alarm technicians supervising the installation of equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.2.3 Technician

Fire alarm technicians with a minimum of four years of experience must be utilized to install and terminate fire alarm devices, cabinets and control units. The fire alarm technicians installing the equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.2.4 Installer

Fire alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm devices, cabinets and control units. A licensed electrician must be allowed to install wire, cable, conduit and backboxes for the fire alarm system system. The fire alarm installer must be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.7.2.5 Test Technician

Fire alarm technicians with a minimum of eight years of experience and NICET Level III or IV utilized in testing and certification of the installation of the fire alarm devices, cabinets and control units. The fire alarm technicians testing the equipment must be factory trained in the installation, adjustment, testing, and operation of the equipment installed as part of this project.

1.7.2.6 Manufacturer

Components must be of current design and must 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 specified herein.

1.7.3 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 any item of 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 must be considered as mandatory requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENT

All fire alarm equipment must be listed for use under the applicable reference standards.

2.2 MATERIALS AND EQUIPMENT

2.2.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory and listed 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 must be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening.

2.3 MANUAL STATIONS

Provide metal or plastic, surface mounted, double-action, manual stations, that are not subject to operation by jarring or vibration. Stations must 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 must be finished in red with molded raised lettering operating instructions of contrasting color. The use of a key must be required to reset the station.

2.4 NOTIFICATION APPLIANCES

2.4.1 Audible Notification Appliances

Audible appliances must conform to the applicable requirements of UL 464. Appliances must be connected into notification appliance circuits. Surface mounted audible appliances must be painted red.

2.4.1.1 Horns

Horns must be surface-mounted, with the matching mounting backbox surface mounted vibrating type suitable for use in an electrically supervised circuit.

2.4.2 Visual Notification Appliances

Visual notification appliances must conform to the applicable requirements of UL 1638, UL 1971 and conform to the Architectural Barriers Act (ABA). Visual Notification Appliances must have clear high intensity optic lens, xenon flash tubes, or light emitting diode (LED) and be marked "Alert" in letters of contrasting color. The light pattern must be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate must be 1 flash per second and a minimum of 75 candela based on the UL 1971 test. Strobe must be surface mounted.

2.5 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.5.1 Alarm Wiring

IDC wiring must be solid copper cable in accordance with the manufacturers requirements. Copper initiating device circuit field wiring must be No. 16 AWG size conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, must be copper No. 14 AWG size conductors at a minimum. Wire size must be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC must not operate at less than the listed voltages for the detectors and/or appliances. Power wiring, operating at 120 VAC minimum, must be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Nonpower-limited cables must comply with NFPA 70.

PART 3 EXECUTION

3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work is in any way dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative any condition which 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

3.2.1 Manual Stations

Locate manual stations as required by NFPA 72 and as indicated on the drawings. Mount stations so they are located no farther than 5 feet from the exit door they serve, measured horizontally. Manual stations must be mounted at 42 inches measured to the operating handle.

3.2.2 Notification Appliances

- a. Locate notification appliance devices as required by NFPA 72 Where more than two visual notification appliances are located in the same room or corridor or field of view, provide synchronized operation. Devices must use screw terminals for all field wiring.

3.3 SYSTEM FIELD WIRING

3.3.1 Wiring within Cabinets, Enclosures, and Boxes

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 must be connected to screw-type terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. The use of wire nuts or similar devices is prohibited. Wiring to conform with NFPA 70.

Indicate the following in the wiring diagrams:

- a. 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 must show connections from field devices to the FACU and remote fire alarm control units, initiating circuits, switches, relays and terminals.

- b. 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.

3.3.2 Alarm Wiring

- a. Voltages must not be mixed in any junction box, housing or device, except those containing power supplies and control relays.
- b. Utilize shielded wiring where recommended by the manufacturer. For shielded wiring, ground the shield at only one point, in or adjacent to the FACU.
- c. Color coding is required for circuits and must be maintained throughout the circuit. Conductors used for the same functions must be similarly color coded. Conform wiring to NFPA 70.
- d. Pull all conductors splice free. The use of wire nuts, crimped connectors, or twisting of conductors is prohibited. Where splices are unavoidable, the location of the junction box or pull box where they occur must be identified on the as-built drawings. The number and location of splices must be subject to approval by the Designated Fire Protection Engineer (DFPE).

3.3.3 Back Boxes and Conduit

In addition to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size must be 3/4-inch in diameter. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

- a. Electrical metallic tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. Do not use EMT underground, encased in concrete, mortar, or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.
- b. Exterior wall penetrations must be weathertight. Conduit must be sealed to prevent the infiltration of moisture.

3.3.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACU, and remote FACU must be provided at each conductor connection. Each conductor or cable must have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACU, and remote FACU must contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing must be neat, using 12 point lettering minimum size, and mounted within each cabinet, control unit, or unit so that it does not interfere with the

wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.4 PAINTING

- a. In unfinished areas (including areas above drop ceilings), paint all exposed electrical conduit (serving fire alarm equipment), fire alarm conduit, surface metal raceway, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish.
- b. In finished areas, paint exposed electrical conduit (serving fire alarm equipment), fire alarm conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Fire Alarm" and the conduit must have painted red bands 3/4-inch wide at 10-foot centers and at each side of a floor, wall, or ceiling penetration.

3.5 FIELD QUALITY CONTROL

3.5.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level III or IV Fire Alarm Technician, and the representative of the installing company, 60 days prior to performing system tests. Detailed test procedures must list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, and surge protective devices. 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 72 and NFPA 4.) The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government testing. The test data forms must record the test results and must:

- a. Identify the NFPA Class of all Initiating Device Circuits (IDC), and Notification Appliance Circuits (NAC).
- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how these tests must 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 smoke detector testing. The use of magnets is not permitted.

- 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 Pre-Government Testing

3.5.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that devices and circuits are functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" as required by NFPA 72. The contractor and an authorized representative from each supplier of equipment 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 72 including all referenced annex sections and the test reports noted below.

- a. NFPA 72 Record of Completion.
- b. NFPA 72 Record of Inspection and Testing.
- c. Fire Alarm and Emergency Communication System Inspection and Testing Form.
- d. Audibility test results with marked-up test floor plans.
- e. Documentation that all tests identified in the paragraph "Minimum System Tests" are complete.

3.5.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the Contracting Officer's Representative (COR). 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 installation-wide fire reporting system has 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.

3.5.3 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.

3.5.4 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. Marked-up red line drawings of the system as actually installed.
- c. Loop resistance test results
- d. Copy of pre-Government Test Certificate, test procedures and completed test data forms.
- e. Audibility test results with marked-up floor plans.

Government Final Tests will be witnessed by the Contracting Officer's Representative (COR). At this time, any and all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.6 MINIMUM SYSTEM TESTS

3.6.1 System Tests

Test the system in accordance with the procedures outlined in NFPA 72. The required tests are as follows:

- a. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests must be witnessed by the Contracting Officer and test results recorded for use at the final Government test.
- b. Verify the absence of unwanted voltages between circuit conductors and ground. The tests must be accomplished at the pre-Government test with results available at the final system test.
- c. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- d. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Smoke detectors must be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors must comply with the requirements of NFPA 72 except

disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision must be tested at each device.

- e. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- f. 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.
- g. Determine that the system is operable under trouble conditions as specified.
- h. Visually inspect wiring.
- i. Test the battery charger and batteries.
- 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. Verify the documentation cabinet is installed and contains all as-built shop drawings, product data sheets, design calculations, site-specific software data package, and all documentation required by paragraph titled "Test Reports".

3.6.2 Audibility Tests

Sound pressure levels from audible notification appliances must be a minimum of 15 dBa over ambient with a maximum of 110 dBa in any occupiable area. The provisions for audible notification (audibility and intelligibility) must be met with doors, fire shutters, movable partitions, and similar devices closed.

3.7 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. 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 Government 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 Government Test.

- a. 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 and portable document formats of as-built drawings and schematics.
- b. Include complete wiring diagrams showing connections between devices and equipment, both factory and field wired.
- c. Include a riser diagram and drawings showing the as-built location of devices and equipment.
- d. Provide Operation and Maintenance (O&M) Instructions.

END OF SECTION

SECTION 31 0010 - SITE PROTECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The General Provisions of the Contract including requirements of the Government's Solicitation and Division 01 specifications apply to the work specified in this section.

1.02 DESCRIPTION

- A. The Work of this Section includes the protection and preservation from injury or defacement of all vegetation and objects designated to remain. The contractor shall employ an arborist to instruct contractor on preservation of site trees to remain.
- B. The Contractor is solely responsible for controlling runoff and siltation from the site and onto protected or undisturbed areas of the site or adjacent sites.
- C. The Work of this Section is incidental to the Contract and will not be paid for separately except where unit prices may be in effect.

1.03 QUALITY ASSURANCE

- A. Reference Standards:

- 1. General:
 - a. Listings: Issues listed by reference, including revisions of issuing authority, form part of this specification section to extent indicated. Issues listed are identified by number, edition, date, title, or other designation established by issuing authority. Issues subsequently referred to are referred to by an issuing authority abbreviation and a basic designation.
 - b. Modification: Modifications (by the Government) to reference standards, if any, are noted with standard.
- 2. Alabama Department of Transportation (ALDOT), Standard Specifications for Highway Construction, Latest Edition:
- 3. Alabama handbook for "Erosion Control, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas", published by Alabama Soil and Water Conservation Committee.
- 4. Local Codes, Ordinances, Regulations.
- 5. Local Codes, Ordinances, Regulations on tree protection.

- B. Job Meeting: Before proceeding with site clearing operations, review site features to remain and be protected at the site with the Government.
- C. Tree Damages: Extreme care to be taken to save trees that are shown to remain.
 - 1. If any trees to be saved are severely injured so as to cause a loss of natural character to the crown, or so as to impair the life support system or to cause death as a result of construction operation, the Contractor agrees to pay two hundred dollars (\$200) per one inch (1") of caliper, measured four feet (4') above the ground, for trees one inch (1") in caliper and larger, as fixed and liquidated damages, as determined by the Government.
 - 2. Severely damaged trees requiring liquidated damages will be determined by the Government. In lieu of liquidated damages replace trees damaged beyond repair or killed with trees of same specie and size.
 - 3. Damaged trees which are repairable as determined by the Government shall be repaired by a qualified tree surgeon, approved by the Government, and whose services will be at the Contractor's expense.
 - 4. Clean up and repair damages to the Government's satisfaction.
- D. Protect existing sidewalks and curbs to remain to include those in non-work areas.

PART 2 PRODUCTS

2.01 PRODUCT/MATERIAL DESCRIPTION

- A. Tree Protection Fencing:
 - 1. Provide and install six-foot (6') high chain link fence, including gates, in accordance with AHD Section 871.
 - 2. Zinc coated steel fabric or wire not less than (9) gauge.
 - 3. Hot-dipped galvanized steel fence supports, framing and fittings of specified sized and weights.
 - 4. Install at limits of tree protection fencing as required to protect tree canopy and roots.

PART 3 EXECUTION

3.01 JOB CONDITIONS

- A. It is intended that the part of the property on which new construction does not occur remain undisturbed and as is, except as noted on Drawings and in Specifications.

- B. Confine storage of materials, temporary facilities, and staging to areas approved by the Government.
- C. Do not carry on construction operations or materials storage within five feet (5') of tree protection fencing.

3.02 TREE PROTECTION

- A. Protect all trees and vegetation to be preserved against damage during construction operations by:
 - 1. Installation of chain link fence as required to protect trees.
 - 2. Installation of hay bales or silt fencing to protect vegetation to remain from siltation, as shown on Drawings or as directed.
- B. Place tree protection before clearing, topsoil stripping, grading, or excavation is begun.
- C. Maintain tree protection in good repair for the duration of the construction operation, or until directed to remove.
- D. Protect Root Systems:
 - 1. Do not permit construction operations, storage material, construction, trailers, etc., within the tree protection fencing.
 - 2. Protect tree roots (area under tree canopy) from damage due to noxious materials in solution caused by run-off or spillage during mixing and placement of construction materials, or drainage from stored materials.
 - 3. Protect from flooding or excessive wetting.
- E. Watering: In case of extreme drought during construction, provide water to specimen trees or groups of trees as determined by the Government.
- F. Earthwork around trees:
 - 1. Maintain existing grade within drip line of trees unless otherwise indicated; where necessary next to new construction, limit earthwork around trees as much as possible.
 - 2. Where trenching or utilities is required within drip line, advise the Government before proceeding. Where roots are pruned, cut sharply and cleanly (do not chop or beak). Hand excavate where directed.
 - 3. Do not allow exposed roots to dry out before permanent fill is placed; provide temporary cover, or pack with peat moss and wrap with burlap; keep moist.

G. Repair of Damaged Trees:

1. Repair tree damaged by construction operations promptly after damage occurs and in a manner acceptable to the Government.

END OF SECTION

SECTION 31 0200 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Government for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).
- C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2011.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.
- F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002 (Reapproved 2009).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. Alabama Department of Transportation Standard Specification for Highway Construction, latest edition.
- I. All Soil Erosion and Sediment Control Ordinances in force by Federal, State and Local Governments.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus 2021.
- B. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles 2015.
- C. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles 2015a.
- D. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile 2021a.
- E. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples 2017 (Reapproved 2021).
- F. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit Current Edition.

1.04 PERMITS, RESPONSIBILITY, PERFORMANCE & FINES/PENALTIES REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of State of Alabama Erosion and Sedimentation Control Manual.
- C. The contractor will be solely responsible for all erosion and sediment control issues. This includes, but is not limited to: installing, maintaining, repairing and replacing erosion and sedimentation controls as shown on the drawings and any additional as required during construction. Should any of the erosion and sedimentation controls fail to produce results, the contractor shall immediately take whatever steps are necessary to correct the deficiencies. If deficiencies in the erosion and sedimentation controls cause any damage downstream and/or any fines/penalties are imposed, the contractor shall pay all repair costs and fines/penalties.
- D. Contractor shall acquire services of a qualified professional to perform inspections.
- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

1. Obtain and pay for permits and provide security required by authority having jurisdiction.
 2. Government will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
1. Control movement of sediment and soil from temporary stockpiles of soil.
 2. Prevent development of ruts due to equipment and vehicular traffic.
 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Government.
- I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
 2. Prevent tracking of mud onto public roads outside site.
 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Government.
- J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Government; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Government; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. See Section 01 3001 - Administrative Requirements, for submittal procedures.
- B. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- D. Provide written declaration that erosion control measures have been inspected by the contractor at least weekly and following rainfall and repaired by the contractor.
- E. Provide documentation demonstrating that the Erosion and Sedimentation Control (ESC) Plan was carried out appropriately. Provide a summary, sample log, checklist, inspection report, or similar documentation that demonstrates periodic inspection of the implemented measures. This documentation must include:
 1. Sample dates.
 2. Inspection frequency (at least monthly, year-round).
 3. At least 3 inspections equally spaced over the site work period.

4. Description of any corrective action taken.

1.06 SUSTAINABILITY REQUIREMENTS

- A. Contractor shall endeavor to provide materials with a high Biobased content where possible.
 1. See Part 2 of this specification section for specific biobased content thresholds, if applicable.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 1. Straw or hay.
 2. Wood waste, chips, or bark.
 3. Erosion control matting or netting.
 4. Cutback asphalt.
 5. Polyethylene film, where specifically indicated only.
 6. Mulching materials and erosion control fabric shall meet the requirements of the USDA BioPreferred Program
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
 1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.

- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533/D4533M.
 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 2. Softwood, 4 by 4 inches (100 by 100 mm) in cross section.
 3. Hardwood, 2 by 2 inches (50 by 50 mm) in cross section.
- G. Gravel: See Section 32 1123 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Width: As required; 20 feet (7 m), minimum.
 - 2. Length: 50 feet (16 m), minimum.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet (30 m)..
 - b. Slope Between 2 and 5 Percent: 75 feet (23 m).
 - c. Slope Between 5 and 10 Percent: 50 feet (15 m).
 - d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
 - e. Slope Over 20 Percent: 15 feet (4.5 m).
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

- G. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
 2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.
- H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
 2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.
- I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches (150 mm).
 2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
 3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.
- B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 5. Install with top of fabric at nominal height and embedment as specified.

6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
7. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gage, 0.083 inch (2.11 mm) shank diameter.
 - b. Five staples per post with at least 17 gage, 0.0453 inch (1.150 mm) wire, 3/4 inch (19 mm) crown width and 1/2 inch (12 mm) long legs.
8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches (100 mm) in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:

1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
2. Wood Waste: Apply 6 to 9 tons per acre (15,200 to 20,800 kg per hectare).
3. Asphalt: Apply at 1200 gallons per acre (11,000 L per hectare).
4. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:

1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
2. Wood Waste: Apply 2 to 3 inches (50 to 75 mm) depth.
3. Asphalt: Apply 1/4 gallon per square yard (1 L per 100 sq m).
4. Erosion Control Matting: Comply with manufacturer's instructions.

F. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the bales.
3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by the Government.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

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SECTION 31 1001 - SITE CLEARING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees and vegetation to remain to include all site trees unless shown removed.
 - 2. Removing trees and other vegetation.
 - 3. Clearing and grubbing.
 - 4. Topsoil stripping.
 - 5. Removing above-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
 - 7. Disconnecting, capping or sealing, and removing site utilities.

1.03 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.04 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Government property, cleared materials shall become Contractor's property and shall be removed from the site.

1.05 SUBMITTALS

- A. Record drawings according to Division 1 Section "Contract Closeout."
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Government and authorities having jurisdiction.
- B. Notify utility locator service for area where Project is located before site clearing.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain.
 - 1. Restore damaged improvements to their original condition, as acceptable to the Government.

3.02 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.03 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 1. Arrange to shut off indicated utilities with utility companies.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify the Government not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the Government's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Limit height of topsoil stockpiles to 72 inches.
 2. Do not stockpile topsoil within drip line of remaining trees.
 3. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.06 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.07 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Government's property.

END OF SECTION

SECTION 31 2210 - EARTHWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Excavating and backfilling for bstructures.
 - 3. Fine grading, topsoiling and preparing lawn areas.
 - 4. Excavating and backfilling trenches within building lines.
 - 5. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
 - 6. Geotechnical Reports applicable to this project.
 - 7. Preparing crushed aggregate base for building and pavement areas.
- B. Related Sections include the following:
 - 1. Division 32 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
 - 2. Division 32 Section "Sodding" for placing of sod for lawn areas.

1.03 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

- D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by the Government. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by the Government. Unauthorized excavation, as well as remedial work directed by the Government, shall be without additional compensation.
- F. Fill: Soil materials used to raise existing grades.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

- A. Material Test Reports: Submit following reports directly to the Government from the testing services, with copy to the Contractor.
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
 - 3. One optimum moisture density curve for each type of soil encountered.
 - 4. Verification of each footing subgrade.

1.05 QUALITY ASSURANCE

- A. Geotechnical Testing Agency: Soil testing and inspection service for quality control testing during earthwork operations shall be furnished by the Contractor. Retesting of failed test to be provided and paid for by the General Contractor.
- B. Prior to the installation or placement of concrete into insitu soil (load bearing earth), the Contractor shall receive acknowledgement from the Testing Company that the soil where the concrete is to be placed meets all compaction and other testing requirements specified and/or required by the onsite testing agent. This approval with all drawings showing pertinent information indicating that day's work attached shall be signed and dated by the onsite Testing Agent and the Contractor's Superintendent and presented to the Government onsite.
 - 1. The testing agency shall report to the contractor the results of all required tests, which shall be reviewed and acknowledges by the General Contractor and then submitted to the Government. The General Contractor shall not submit any failed soil density concrete or other test result(s) to the Government without including the applicable recheck test result(s) that indicate compliance with the Specifications. The recheck test result(s) shall be identified with the same number as the failed test with the notation "-R".

1.06 PROJECT CONDITIONS

- A. Site Information: The report of subsurface investigation is bound herein. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Government will not be responsible for interpretations or conclusions drawn therefrom by Contractor.
 - 1. Additional test borings and other exploratory operations may be made by Contractor at no cost to the Government.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted in writing by the Government and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify the Government not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without the Government's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.

- C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- D. Recommendations made in the reports of subsurface investigation bound herewith after this section shall be a requirement of these specifications. Where conflicts occur between the report and this specification, the more stringent requirement shall govern.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Base: Crushed aggregate base in accordance with requirements of Section 825 of the State of Alabama Department of Transportation Standard Specifications for Highway Construction, Latest Edition, unless noted otherwise.
- F. Structural Fill: Refer to Geotechnical Engineering Report prepared by Carmichael Engineering, Inc. Dated May 23, 2022 for structural fill material requirements.
- G. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Topsoil: Topsoil shall be a natural, workable, friable, loamy soil, without admixture of subsoil, refuse, or foreign materials, suitable for growing grasses or other vegetative ground cover. Topsoil shall be furnished by the Contractor from an off-site source approved by the Government if required to supplement previously stockpiled on-site topsoil.

2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.

- 1. Tape Colors: Provide tape colors to utilities as follows:

Red: Electric

Yellow: Gas, oil, steam, and dangerous materials.

Orange: Telephone and other communications.

Blue: Water systems.

Green: Sewer systems.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.05 EXCAVATION FOR STRUCTURES

- A. The building “control area” shall be prepared as recommended by the Geotechnical Engineering Report, prepared by Carmichael Engineering, Inc., for this project.
- B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches on each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 6 inches deeper than elevation required in unyielding bearing material to allow for bedding course.

3.08 APPROVAL OF SUBGRADE

- A. Notify the Government when excavations have reached required subgrade.
- B. If the Government determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Government.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by the Government.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by the Government.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill material, free of particles larger than 1 inch to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.

- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use satisfactory or structural fill.
 - 4. Under building slabs, use satisfactory or structural fill.
 - 5. Under footings and foundations, use satisfactory or structural fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs and steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 98 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: plus or minus ½ inch.
- C. Topsoil: All areas disturbed by grading or other construction operations or as shown on the Site Plan, not occupied by the building or pavement, shall receive 4 inch minimum thickness topsoil from on-site stockpile or from approved off-site sources.
- D. It shall be the contractor's responsibility to hold finished grade including landscaping to grade shown on civil drawings. Do not cover over masonry weeps. Do cover concrete foundations so that no concrete is exposed.

3.17 BASE COURSES

- A. Under pavements, place base course material on prepared subgrades.
 1. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent of ASTM D698 relative density.
 2. Shape base to required crown elevations and cross-slope grades.

3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.18 PLANTING SOIL PREPARATION

- A. Limit subgrade to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Spread topsoil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
 1. Place approximately ½ the thickness of topsoil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
 2. Allow for sod thickness in areas to be sodded.
- D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
 1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
 2. Till surface soil to a depth of at least 6 inches. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
 3. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Government's property.
- E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with planting or maintenance operations.

- F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.19 DRAINAGE COURSE

- A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Government.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556. Tests will be performed at the following locations and frequencies:
 - 1. Building Slab and Pavement Areas: At subgrade and at each compacted fill and backfill layer, at least four tests for each foot of vertical thickness placed on the building area and one in the pavement area, but in no case fewer than three tests.
 - 2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 50 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by the Government; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Government's property, unless instructed otherwise by the Contracting Officer.

END OF SECTION

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Report of Geotechnical Subsurface Investigation

117th Air National Guard GASNT Storage Development

Building 30
Birmingham, Alabama
Our Job No. G22-6518



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Report of Geotechnical Subsurface Investigation

117th Air National Guard GASNT Storage Development

Building 30
Birmingham, Alabama
Our Job No. G22-6518

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 General Conditions



1.0 Introduction

Carmichael Engineering, Inc., is pleased to provide this report of our subsurface investigation for the proposed 117th Air National Guard GASNT Storage Development. The scope of this investigation included 3 soil test bores in the proposed building and concrete pad area. The quantity and location of the test bores were taken in accordance with the authorized scope of work. The intent of this investigation was to evaluate the subsurface conditions with respect to the development of the site for support of the proposed building and concrete pad.

This report has been prepared in accordance with generally accepted current standards of geotechnical engineering practices and no other warranties are expressed or implied. The recommendations of this report are based on our professional judgment considering the proposed construction as described by this report and the data available to us. The construction should include follow up geotechnical monitoring and construction materials testing by our firm. It is important that we confirm the expected subsurface conditions based on the soil boring data during the construction phase. This report is presented on the basis that all of our recommendations will be followed.



2.0 Summary

Generally, the subsurface investigation indicated conditions which should be compatible with the planned development provided the site preparation and construction are completed in accordance with the recommendations which follow in this report. Please note that our recommendations are site specific and may not be suitable for other types of structures or other locations.

A total of 3 test bores were completed to evaluate the subsurface stratigraphy. Beneath organic clayey sandy or silty sandy topsoil, the test bores penetrated possible fill and in-situ earth described as cohesive clayey sand, silty clay, sandy plastic clay (sections with gravel), and non-cohesive silty sand (sections with gravel). Two of the test bores auger refused on hard rock at depths of 12.5 and 17' below ground surface. The predominate clay earth is of a poor drainage classification and is sections of the clay earth are expansive. The predominate sand earth is of a marginal to good drainage classification. Beyond localized weak soil zones in the upper 5' of earth, the test bores indicated moderate soil strengths and consolidation characteristics which are expected to be compatible with the planned type of construction.

One hour following drilling, the test bores indicated water levels at depths of 9.3 to 11.8' below ground surface. It should be noted that localized shallow seasonal "perched" water conditions are common in the clay earth typical of that penetrated at this site. Generally, water which permeates the ground surface travels along thin seams within the clay earth. In open excavations groundwater seepage can be encountered at various levels due to the irregular nature of the water carrying seams. The groundwater condition at this site is subject to seasonal variation and is expected to fluctuate. We do not expect that the groundwater condition will affect the construction or long-term performance of this project. Shallow groundwater (if any) encountered during construction can be controlled using shallow drainage ditches, sump pumps, and/or permanent underdrains.

The expansive and poor drainage classification of the clay earth predominate at this site is one of the primary concerns for the site development and the design of foundations, floor slabs and pavements. The expansive clay soil can undergo volume change when subjected to fluctuating moisture contents and can cause severe damage to foundations, floor slabs, etc., which bear in or near the zone of moisture fluctuation. Providing adequate surface drainage during and following construction is critical to the performance of the foundations and floor slabs. Furthermore, site preparation during the normally wetter winter and spring seasons can cause significant time delays in the construction due to the difficulty of processing the native clay earth when in a wet or saturated condition.

Following removal of the topsoil and/or cut earth and prior to the placement of fill earth, the exposed subgrade should be moisture conditioned and compacted to at least 95% standard density. At the time of densification, the moisture content of the subgrade should be adjusted to 2 to 3% above the materials optimum water content. Areas which fail to compact should be undercut to expose firm earth followed by backfilling with "engineered fill". Site preparation



can be best achieved in the normally drier summer and fall seasons when drying conditions are optimal. Processing (drying and compacting) may not be practical in the normally wetter winter and spring seasons. During wet periods, undercutting and replacing the soft, wet sections of native clay may be required to facilitate the construction.

Following proper site preparation, the project can use conventional design and construction techniques to develop a shallow spread foundation system for support of the proposed building. These spread foundations can be designed to bear below the level of anticipated seasonal moisture change in the firm to stronger sections of in-situ earth. The spread foundations may be designed using net allowable soil bearing pressures of up to 2,000 pounds per square foot for isolated square foundations and 1,500 pounds per square foot for continuous foundations.

Considering the expansive and poor drainage classification of the clay earth at this site, we recommend that a 9" thickness of ALDOT crushed aggregate base be placed for floor slab and concrete pavement support. The intent of the crushed stone base layer is to minimize moisture variation which can occur in the native expansive clay soil during construction and to provide a stable base for floor slab and pavement support. Maintaining adequate surface drainage of the subgrade during construction is critical to the performance of ground supported floor slabs and pavements.

The recommendations in this report provide an economical approach to the development using shallow foundations and ground supported floor slabs. Please note that there are risks for some movement of the foundations and floor slabs to occur due to the nature of the native clay soil at this site and this movement may cause cracking and distress in the structure, unlevel floor slabs, etc. In most cases this movement causes cosmetic damage although significant movement may cause some structural damage which could require remedial foundation stabilization and repair. The recommendations in this report are intended to reduce the risk of structural distress, however, extremes in weather conditions during and following construction, changes in drainage conditions, etc., can result in damage to the structure caused by volume changes in the clay soil. There are other methods of construction which can be used to eliminate most of the risks associated with construction in expansive clay soil, however the cost of these alternate methods are substantially more expensive compared to the recommendations provided in this report. These alternate methods incorporate the use of deep foundation systems and structural floor slabs with void spaces. If this alternate method of construction is preferred, we have sufficient data to provide recommendations for the deep foundations and structural floor slabs. Please contact our office for specific alternate recommendations if the risks of differential movement for shallow foundations and ground supported floor slabs are not acceptable.



3.0 Evaluation

3.1 Site Location

The site subject to this report is located at Building 30 at the 117th Air National Guard Facility on E. Lake Boulevard in the City of Birmingham, Jefferson County, Alabama. The test bore locations were located in the field using the provided plans and instructions. The test bore locations should be considered approximate. The enclosed boring plans further describes the test boring locations.

3.2 Site Conditions

The site consisted of a portion of the 117th Air National Guard Base property. The site included the existing Building 30 and related improvements. The planned GASNT shelter building and concrete pad areas were generally clear and open.

The local terrain is described as gently sloping. Surface drainage was described as fair to good. Surface water is expected to flow over and discharge beyond the planned building site. There were no significant areas of ponded surface water located on the site.

Site access was described as good. There was no unusual difficulty mobilizing our rubber-tired CME 550 ATV mounted drilling equipment over the site for the completion of the test bores.

3.3 Site Geology and Subsurface Stratigraphy

Geologically, site is located in the Valley and Ridge Province and is underlain by the Ketona Dolomite formation formed in the Cambrian Period. Typically, this formation yields thick bedded coarsely crystalline dolomite. The upper section of this formation have weathered leaving a residuum of various combinations of clay, silt, and sand.

The test bores penetrated 3 to 7" of organic clayey sandy or silty sandy topsoil. Beneath the topsoil, the test bores penetrated possible fill and in-situ earth described as cohesive clayey sand, silty clay, sandy plastic clay (sections with gravel), and non-cohesive silty sand (sections with gravel). Laboratory analyses confirmed "CH" Unified Soil Classifications of the predominate clay earth with plasticity indices of 30 and 42. The penetration resistance values, "N", ranged from 3 to 100+ blows per foot indicating consistencies of soft to stiff in the predominate clay earth and relative densities of loose to very dense in the predominate sand earth. Moisture tests indicated water contents ranging from 12.1 to 51.9%. The test bores were terminated in the in-situ earth at depths of 12.5 to 17' below existing ground surface. Bores B-1 and B-2 auger refused on hard rock at depths of 12.5 and 17' below ground surface.

One hour following drilling, the test bores indicated water levels at depths of 9.3 to 11.8' below ground surface. The test bores caved at depths of 10.1 to 14.4' below ground surface following drilling.

The enclosed test boring records further describe the subsurface stratigraphy, Unified Soil Classifications, penetration resistance values, moisture contents, water levels, caved depths,



and boring termination depths.

3.4 General Construction Information

The following data was extrapolated from the provided construction information and plans. The construction data described in this section was considered in the formulation of our recommendations; therefore, any significant changes, additions or modifications to the planned development may have a significant impact on our recommendations. We ask that we be advised of any significant errors, omissions, or revisions in the construction data to permit further comment as needed.

We understand the proposed development will include conventional type building construction along with related grading, drainage and concrete pad improvements. The proposed building will include single story height, concrete floor slab on grade, steel frame, and brick or metal veneer type construction. Specific structural loading information was not provided to us. Structural loads are expected to range from 1.0 to 2.5 kips per linear foot for continuous foundations and concentrated loads are expected to range from 10 to 65 kips. We do not expect that the planned construction will be particularly sensitive to usual settlements.

Specific grading information was not provided. Based on the existing grades, we anticipate earth cutting/filling will be less than 2' to establish subgrade elevation for the building and concrete pad development. Fill earth required to establish subgrade elevation is expected to originate from on-site cuts or local off-site borrow sources.



4.0 Recommendations - Site Development

4.1 Development Alternatives

Several alternatives are available for the development of the subject site. With each approach, there is some level of risk to the owner for some differential movement in the structure to develop due to the nature of the native expansive clay. The differential movement can cause cosmetic damage to the structure including cracks in bricks, concrete slabs, sheetrock walls, etc., and severe differential movement can cause structural damage in some cases. Our recommendations are based on using methods and foundation systems which have been proven successful in similar soil conditions. These recommendations are intended to reduce the risk of significant foundation and floor slab movements.

A shallow spread foundation system and ground supported slab with perimeter foundations with mud sills extending below the anticipated zone of seasonal moisture change can be used for this site. This is a common method of construction for sites with expansive clay soils and is expected to be the most economical approach to the site development. However, as with any shallow foundation and ground supported slab system in expansive clay soil, there is a risk of differential movement of the slabs and foundations due to the nature of the native expansive clay soil. The owner must assume this risk when selecting this type of system.

Drilled piers and structural floor slabs with void spaces or crawlspaces are the best foundation system to reduce the risks of structural movement caused by the expansive clay soil. This type of construction is expected to be significantly more expensive than ground supported construction. We are available to provide recommendations for a drilled pier foundation and structural floor slab with a void space or crawlspace if desired.



5.0 Recommendations - Site Preparation

5.1 "Controlled Areas"

Define those areas throughout and 5' beyond the proposed building area, concrete pad area, and throughout significant slopes as "controlled areas".

5.2 Stripping

Remove all vegetation, topsoil, organic clay, stumps, old slabs, old foundations, and otherwise unsuitable materials from the "controlled areas". All unsuitable materials should be wasted off-site or in non-structural areas.

5.3 Drainage

Maintain the "controlled areas" in a drained condition that will insure the continual removal of surface water that may flow over the construction areas. Temporary site drainage, which is critical for the project, can be enhanced by the installation of the final site drainage structures during the early phases of the site development. It is critical that the grades be adjusted to provide positive surface drainage away from the building and concrete pad area.

5.4 Site Examination

Prior to the placement of fill earth and following removal of cut earth, the "controlled areas" should be examined by our firm. This examination should include use proof rolling with construction equipment, test pits, visual examination, supplemental test bores, etc., as needed to determine the presence, location, and extent of any weak soil and/or otherwise unsuitable conditions. Areas which exhibit weak soil or otherwise unsuitable conditions should be corrected in accordance with our recommendations based on the field conditions.

5.5 Proof Rolling and Correction of Weak Soil Conditions

Proof-rolling should be completed using rubber-tired construction equipment or a loaded dump truck weighing 30 tons. Proof rolling should include a minimum of 2 passes in perpendicular directions over the "controlled areas". Areas which yield excessively should be undercut to a firm level followed by backfilling with "engineered fill". Following removal of the topsoil and/or cut earth and prior to the placement of fill earth, the exposed subgrade should be compacted to at least 95% standard density. At the time of densification, the moisture content of the existing subgrade should be adjusted to 2 to 3% above the materials optimum water content. Areas which fail to compact should be undercut to expose firm earth. The ability to process and compact the native soil will be weather dependent. Unit prices should be established for undercutting and replacing soft wet soils that cannot be reasonably processed and compacted due to poor weather conditions.



5.6 Fill Earth

Fill earth required to establish subgrade elevation in the "controlled areas" can consist of the clean, non-saturated, and non-organic sections of the native earth. The use of the native clay earth should be limited to material with moisture contents less than 35%. Moisture conditioning and processing may be required to develop "engineered fills" using sections of the native clay soil.

5.7 "Select Fill"

Fill earth originating from an offsite borrow source should be designated as "select fill". The "select fill" should consist of a clean, non-saturated, and non-organic clayey sand or sandy clay as follows.

"Select Fill" Composition

Sieve Requirements	% Passing
3"	100
No. 4	75 - 100
No. 200	35 - 55
Liquid Limit	40 max
Plasticity Index	8 to 14
Maximum Dry Unit Weight Based on ASTM-698 Standard Density Test	≥ 110 pcf

Please note that the "select fill" should not extend past the limits of the floor slab. All material around the perimeter of the building should consist of the native clay soil.

Note: The that the building floor slab and the concrete pad should be supported by a minimum 9" thick layer of ALDOT 825 crushed aggregate base compacted to 100% modified density.

5.8 "Engineered Fill"

Unless otherwise specified, all fill earth and "select fill" earth placed in the "controlled areas" should be designated as "engineered fill". Place fill earth in thin lifts not to exceed 8" loose measure and thoroughly compact each lift of fill to at least 95% of the materials ASTM D-698 standard density for the native clay and 98% standard density for the "select fill". The top 9" of crushed stone base should be compacted to 100% modified density. At the time of densification, the moisture content of the "engineered fill" should be 2 to 3% above the materials optimum water content for the native clay earth and within 3% of optimum water content for the "select fill" earth. Following acceptance for moisture and density, any "engineered fill" areas which are disturbed should be retested prior to the placement of additional fill earth or structures.



6.0 Recommendations - Shallow Spread Foundations, Ground Supported Floor Slabs and Concrete Pad

6.1 Maximum Net Allowable Soil Bearing Pressures

2,000 pounds per square foot for isolated square foundations.

1,500 pounds per square foot for continuous foundations.

Note: Foundations should bear in the firm to stronger in-situ earth or new “engineered fill” exhibiting "N" values of 9 or greater. Please note that in some sections of the site the depth of the foundations may require increasing to reach suitable bearing material.

6.2 Minimum Foundation Dimensions

Depth - The depth to the bottom of perimeter wall foundations below finish grade should be 42". Increase depth as required to extend foundations through weak soil conditions. The construction documents should establish unit prices to extend the depth of the foundations as required to reach suitable bearing.

- The depth to the bottom of interior foundations below the top of the floor slab should be at least 36". Increase depth as required to extend foundations through weak soil conditions.

Width - Isolated square foundations - 36".
- Continuous wall foundations - 24".
- Turned down slab edges - 16"

Note: All foundations should be sized for total load but should not be less than the preceding minimums. The use of the recommended minimum foundation depths considers that adequate surface drainage is provided at finish subgrade elevation. The placement of vegetation (such as shrubs and/or flower beds) against foundations is discouraged due to the potential for entrapping water in the usually more permeable soil utilized for planting. Underdrains may be used to remove excess water from planted areas. If planted areas (beyond normal topsoil thicknesses and grass vegetation) are utilized adjacent to the building, the foundation depth should be increased by at least the thickness of the topsoil or other porous planting material. Large trees should not be located near the building structure. The owner should be cognizant of the potential damage to foundations and slabs if tree root systems extend beneath or near the foundations.



6.3 Seismic Design

The design parameters for the IBC 2018 are as follows for the planned GASNT Storage Development site in Birmingham, Alabama.

$S_S = 0.294$	$S_{MS} = 0.383$	$S_{DS} = 0.255$
$S_1 = 0.102$	$S_{M1} = 0.153$	$S_{D1} = 0.102$

Site Class C

Seismic Design Category B for Use Group I, II or III and Seismic Design Category C for Use Group IV.

6.4 Settlement and Swell Potential

The planned building structure will be subjected to total long term settlements of up to 1" with differential settlements of up to 0.75". Provided the site is developed following the recommendations in this report, the estimated swell potential is less than 1.0". The building structure should be designed to tolerate these estimated settlements and swells. Control joints should be used at appropriate locations to reduce the effects of differential movement.

6.5 Foundation Construction

Control of the natural water content of the bearing clay soil in the foundation trenches is critical. Do not permit the foundation bearing soil to become saturated or dry excessively.

In order to protect the bearing level of soil from moisture fluctuation, a "mud sill" can be constructed utilizing a 12"+ thick layer of non-reinforced concrete placed in the foundation trench immediately following excavation. The depth of the "mud sill" can be considered as part of the foundation with respect to satisfying the minimum foundation depths. Following placement of the "mud sill", the construction sequence can continue by placing the foundation reinforcement and casting the balance of the foundation concrete over the top of the "mud sill". The "mud sill" should be cleaned of any loose soil or other deleterious materials prior to the placement of the foundation reinforcement and concrete.

The contractor should coordinate the excavation of the foundation trench and delivery of the "mud sill" concrete to the site so that the concrete can be placed immediately following acceptance of the trench. Workmen should not enter trench excavations greater than 4' deep. The trench bottoms should be machine cleaned of all loose material unless the trench is properly shored to permit manual cleaning.

If foundation excavations are permitted to become saturated or dry excessively, the trench should be undercut below the moisture affected zone prior to continuing the construction.

In no case should pervious backfill be used adjacent to the foundations. Backfill should consist of relatively impervious earth typical of the native non-organic clay earth or that specified for "select fill".

All concrete masonry units extending below grade in the expansive clay soil should be



properly reinforced and filled with a suitable concrete mixture.

6.6 Acceptance of Foundation Bearing Levels

All foundation excavations should be examined by the project geotechnical consultant prior to the placement of the "mud sill" or prior to the installation of the foundation reinforcement and concrete. All unacceptable conditions should be corrected in accordance with the geotechnical consultant's recommendations.

6.7 Floor Slab Design

Consideration should be given to the potential for differential slab movement due to the native plastic clay soil characteristics. Stiffened ribbed slabs or thicker flat slabs with heavy reinforcement can provide greater slab stiffness to resist movement caused by volume changes in the native expansive clay. Ribbed stiffened slabs usually include reinforced stiffening ribs at 10 to 12' on center in each direction. An 8" thick flat slab with no. 5 rebar reinforcement at 12" on center in each direction will also provide greater stiffness.

6.8 Floor Slab Bearing Conditions

Floor slabs should bear over properly compacted minimum 9" thickness of ALDOT 825 crushed aggregate base compacted 100% modified density. Provide a minimum 10 mil vapor barrier between the subgrade layer and the floor slab.

6.9 Control/Expansion Joints

All floor slabs and masonry walls should include control/expansion joints to reduce the effects of the usual differential settlement and concrete shrinkage that can occur. The design and location of control/expansion joints should be in accordance with the recommendations of the Portland Cement Association.

6.10 Acceptance of Floor Slab Bearing Levels

All floor slab bearing levels should be examined by the projects geotechnical consultant prior to the placement of the vapor barrier. All unacceptable conditions should be corrected in accordance with the geotechnical consultant's recommendations.

6.11 Concrete Pad

6.0" - 4000 psi compressive strength (550 psi flexural strength) concrete with fiber mesh, maximum 4" slump.
9.0" – ALDOT Section 825 crushed aggregate base (100% modified density).

6.12 Concrete Pavement Joints

The design and location of control joints should be in accordance with the recommendations of the Portland Cement Association. We recommend a maximum joint spacing of 10' for the concrete pad. All joints should be filled with a suitable flexible joint compound to prevent water intrusion at the joints.



7.0 Recommendations - General

7.1 Utility Trenches

All utility trenches (new and existing) extending through the "controlled areas" should be back-filled with "engineered fill".

7.2 Grading and Drainage Improvements

Incorporate finish grades, side drainage ditches, underdrains, etc., to reduce the possibility of ponding surface water within 5' of foundations and significant slopes.

7.3 Vertical Cuts

Vertical cuts greater than 4' or cuts required to remain open for extended periods of time should be sloped or braced as required for the protection of workmen entering deep excavations. Heavy construction traffic and stockpiling of excavated earth or other materials should not be permitted near the top of open unsupported excavations. Current OSHA regulations should be adhered to with respect to excavations for this project.

7.4 Cut and Fill Slopes

Permanent cut and fill slopes should perform satisfactorily as steep as 3(H):1(V) in the native clay earth or "select fill". All slopes should be protected from erosion using suitable vegetation or pavements.

7.5 Quality Control

A qualified geotechnical and construction materials testing consultant should provide the following services;

- 7.5.1 Verify the results of stripping, proof-rolling, and correction of weak soil conditions, quality and density of "engineered fill", and conditions of the foundation and floor slab subgrade bearing levels.
- 7.5.2 Complete soil particle size, atterberg limits and laboratory compaction tests on each different type of fill earth used in the "controlled areas".
- 7.5.3 Complete a minimum of 4 field density test per each 1' of vertical thickness of fill placed in the "controlled areas". Also, a minimum of 1 field density test should be taken for each 50 linear feet per each 2' of vertical thickness of fill placed at utility trenches extending through "controlled areas".
- 7.5.4 Test all structural concrete in accordance with the guidelines established by the American Concrete Institute.



8.0 General Comments

The scope of this study did not include sampling or testing for an environmental analysis or assessment for this site. If an environmental assessment of this site is desired we should be contacted for further comment.

The comments of this report do not consider local flood conditions. The local flood condition/elevation (if any) should be determined and considered in the design of this project.

The frost penetration depth in the area of this project is generally taken to be less than 10". Provided our recommendations for the development of foundations and floor slabs are followed, we do not expect that the frost penetration will have any detrimental effects on the performance of these structures.

The native clay earth penetrated at this site characteristically exhibits low electrical resistivity values and can contribute to the corrosion of metal products. Metal pipes, etc., buried in the native clay should be protected or designed to eliminate the effects of such corrosion.

The comments of this report are based upon our interpretation of the construction information supplied by others, the data collected at the 3 soil test bores, and our visual examination of the site. The evaluation of subsurface conditions based on the 3 test bores taken with this study requires a certain amount of interpolation. Improper site preparation, extremes in climatic conditions, significant changes in locations, grades, time, etc., can each affect ground water, surface, and subsurface conditions. If conditions are encountered as the construction advances which vary significantly from those described by this report, we should be contacted for supplemental comment.

The scope of this investigation is not intended to establish volumetric estimates of the various subsurface materials at the site. Volumetric estimates may require a large number of test bores placed on a close grid to establish reliable cross sections. If volume estimates are required of us for the design/development of this project to advance, please contact us for further comment.

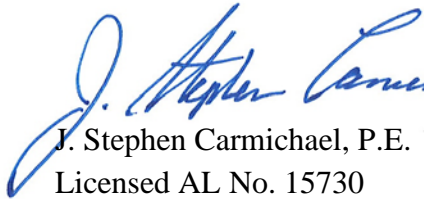
We are available to provide a review of the final plans and project specifications with respect to their compatibility with the contents of this report. Furthermore, our firm would appreciate the opportunity to continue to serve as the geotechnical consultant and to provide the construction materials testing and monitoring for this project.



9.0 Signature

Thank you for selecting Carmichael Engineering, Inc., to provide the geotechnical services for this project. We are available to answer any questions concerning our findings and recommendations. If we can be of any further assistance, please contact our office.

Sincerely,


J. Stephen Carmichael, P.E.
Licensed AL No. 15730

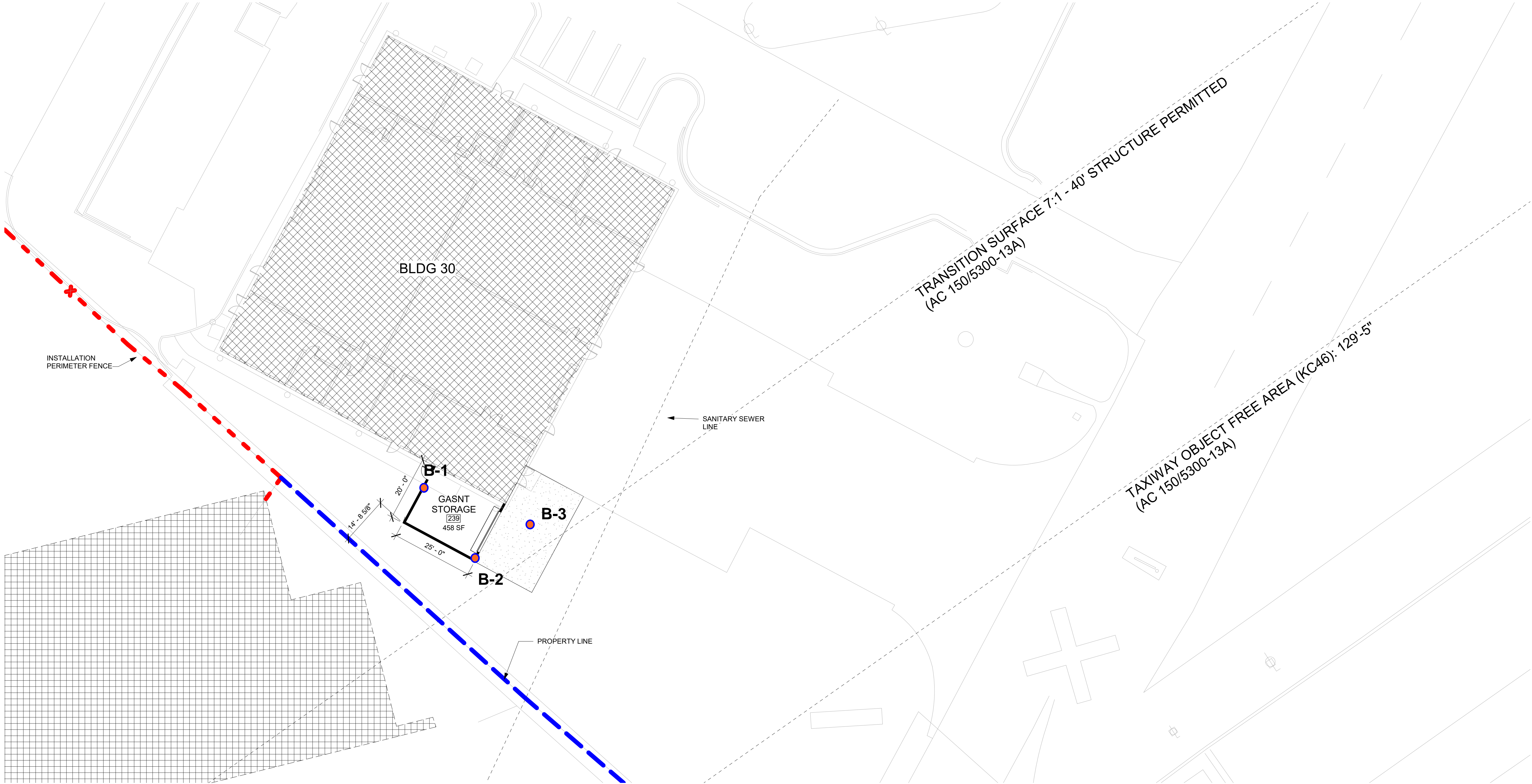


Report Distribution: 1- Mr. David Donovan, Architect

JSC/as



OPTION 1



SS&L

ARCHITECTURE & INTERIOR DESIGN
1115 South Court Street | Montgomery, AL 36104
Tel. 534.263.5162 | WWW.SS&LARCH.COM

No.	Revision	Date

Job Number	21047/BRKR 202911
Date	NOV 30, 2021
Drawn By	NV, PC
Checked By	DCD

Project Title

GASNT Storage
117th Air Refueling Wing
Birmingham, AL

Sheet Title

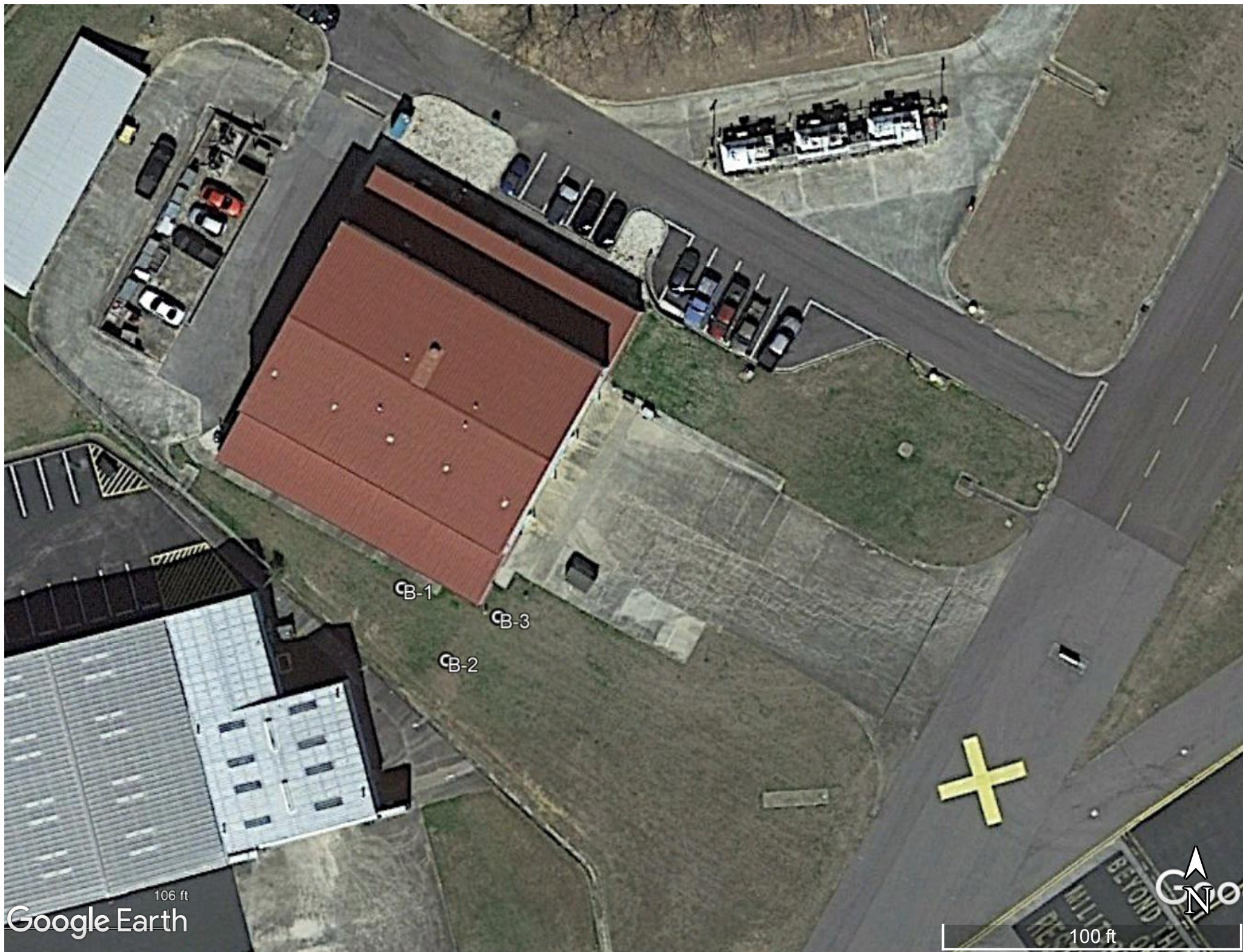
CONCEPTUAL
SITE PLAN

Sheet Number

A2.1b

PRELIMINARY
SUBMITTAL

NOT FOR
CONSTRUCTION
USE



CB-1

CB-3

CB-2

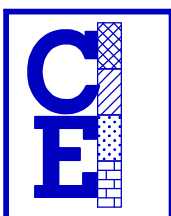
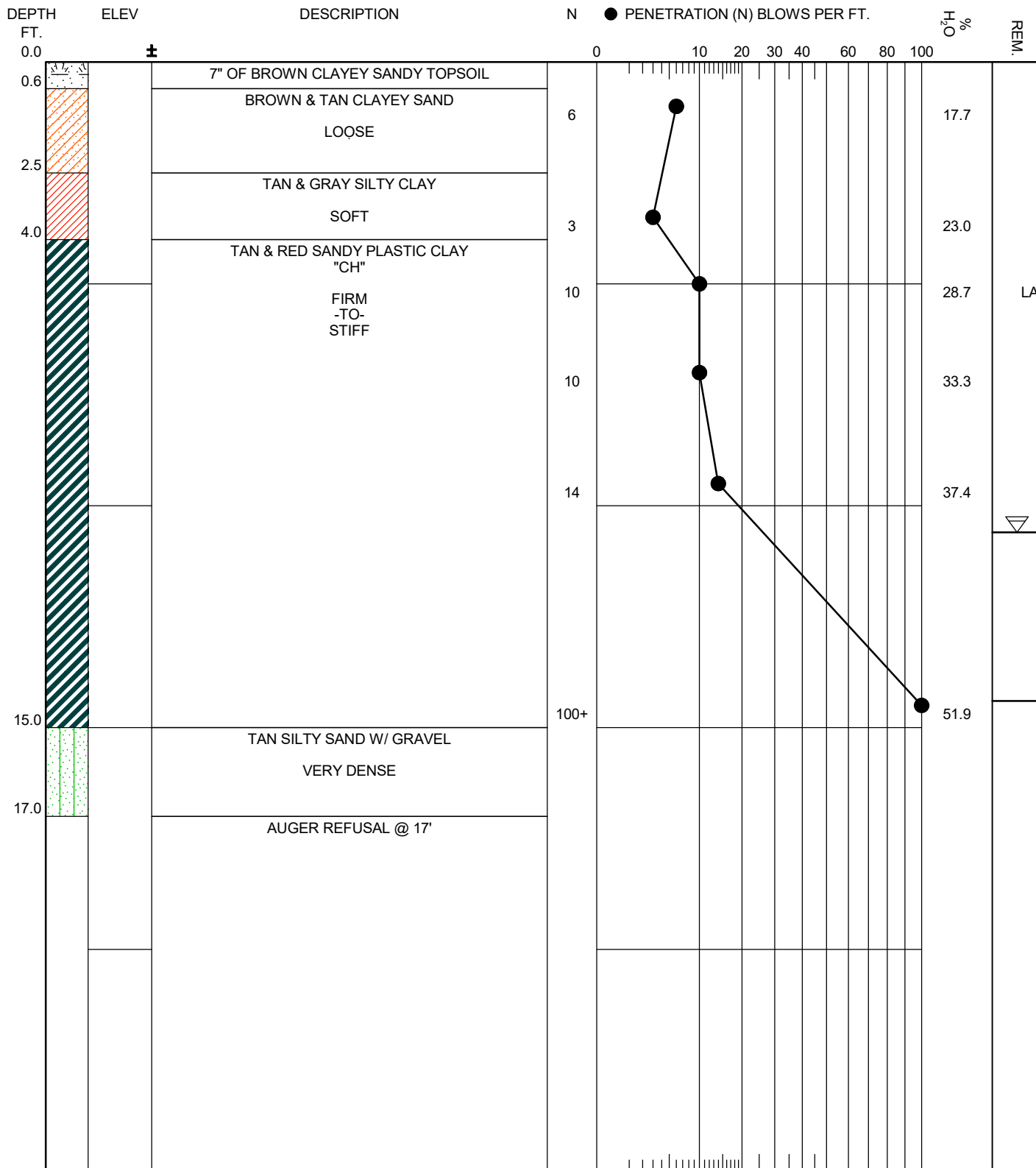
Google Earth 106 ft



100 ft



BEYOND THE MILITARY RESERVE



Boring and Sampling Meets ASTM D-1586
 Penetration (N) is the Number of Blows of 140 lb. Hammer
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

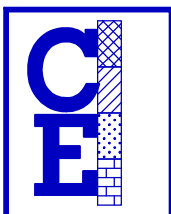
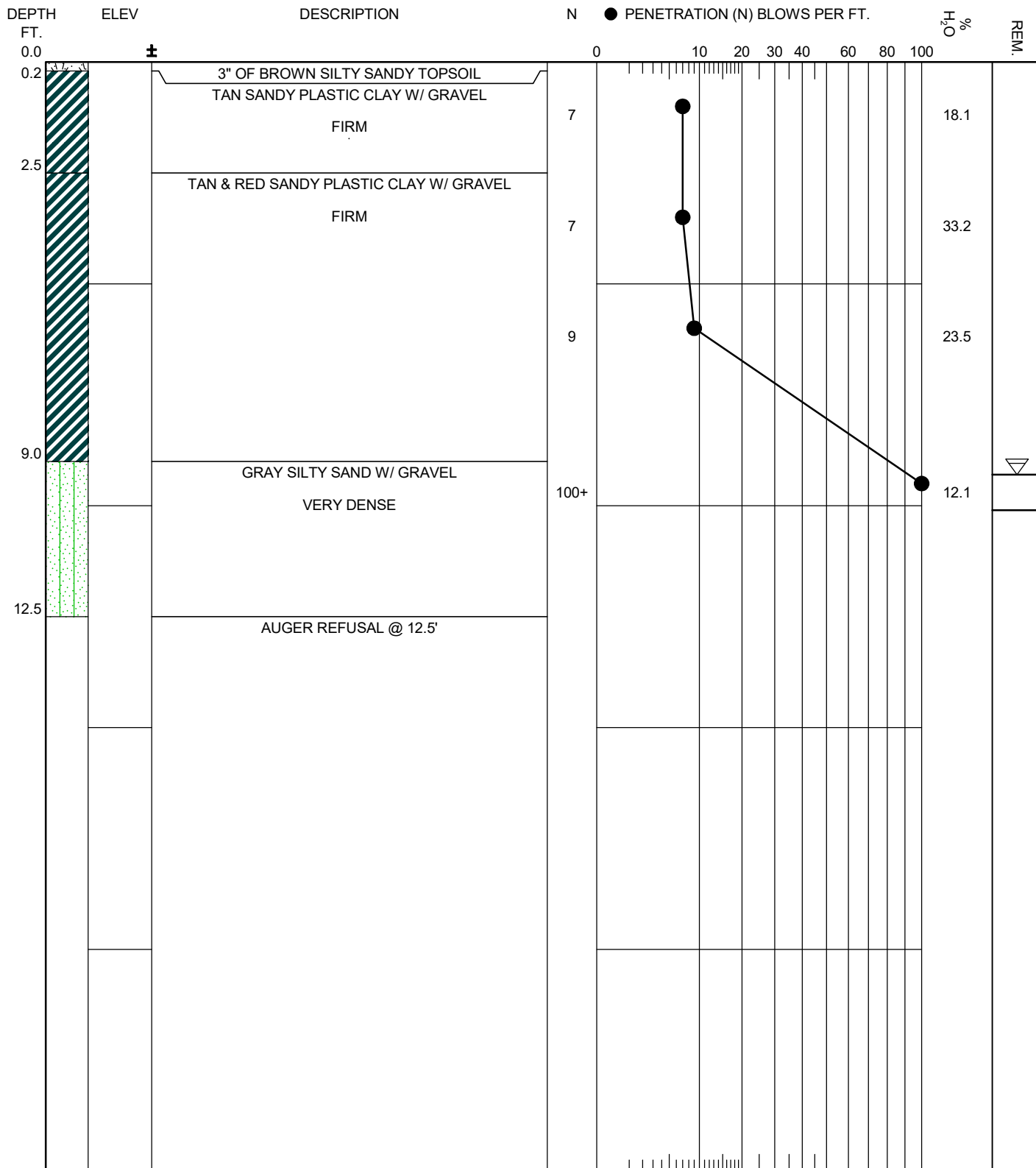
☒ Undisturbed Sample
 LA Lab Analysis

▼ Water Level
 ▽ Water Level 10.6' AFTER 1 HOUR
 — Boring Caved 14.4' AFTER 1 HOUR

CARMICHAEL
 ENGINEERING, INC.

TEST BORING LOG

JOB NO. G22-6518
 BORING NO. B-1
 DATE DRILLED 4/28/22
 TYPE BORING SB



Boring and Sampling Meets ASTM D-1586
 Penetration (N) is the Number of Blows of 140 lb. Hammer
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

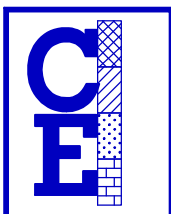
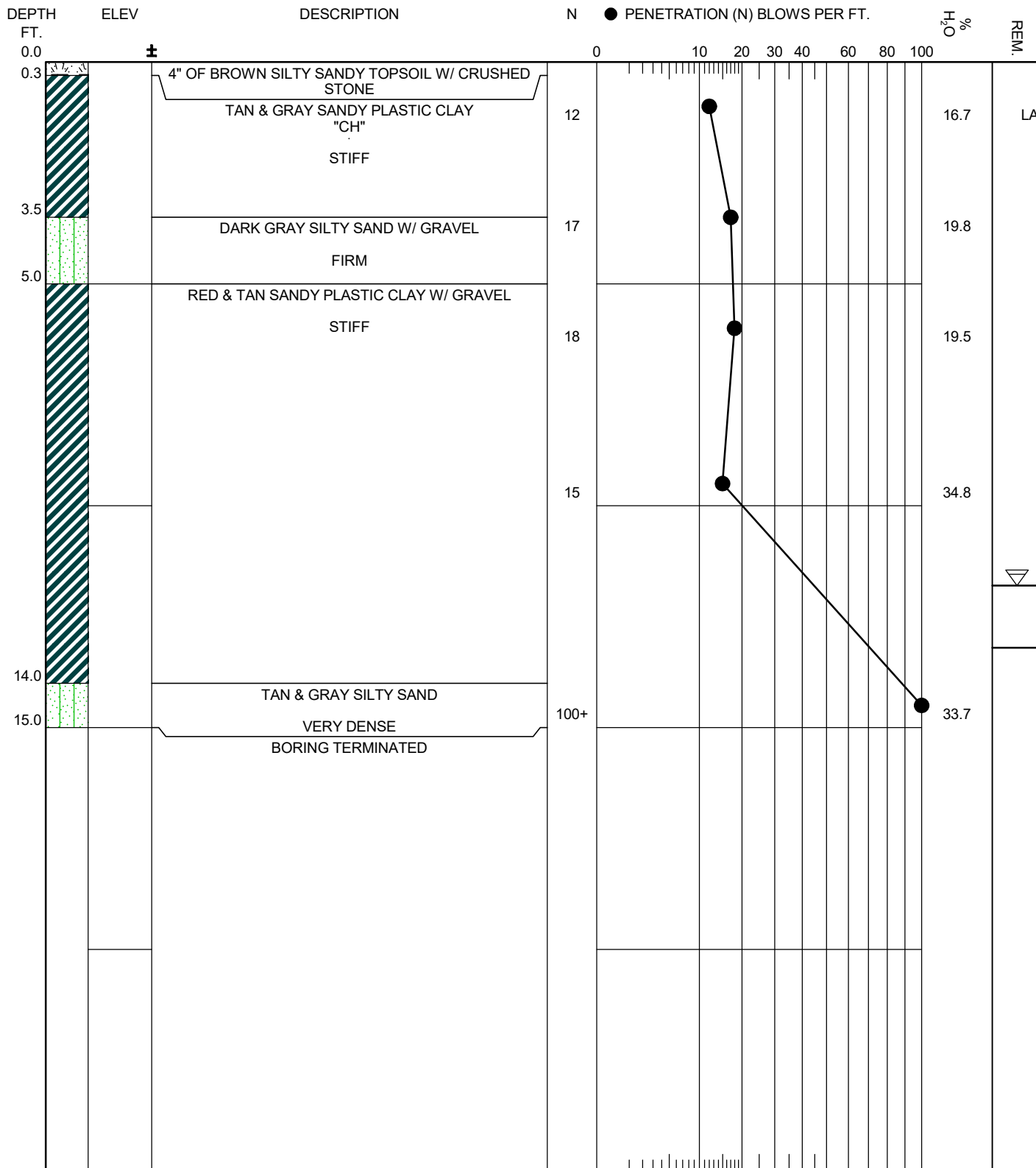
☒ Undisturbed Sample
 LA Lab Analysis

Water Level
 Water Level 9.3' AFTER 1 HOUR
 Boring Caved 10.1' AFTER 1 HOUR

CARMICHAEL
 ENGINEERING, INC.

TEST BORING LOG

JOB NO. G22-6518
 BORING NO. B-2
 DATE DRILLED 4/28/22
 TYPE BORING SB



Boring and Sampling Meets ASTM D-1586
 Penetration (N) is the Number of Blows of 140 lb. Hammer
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

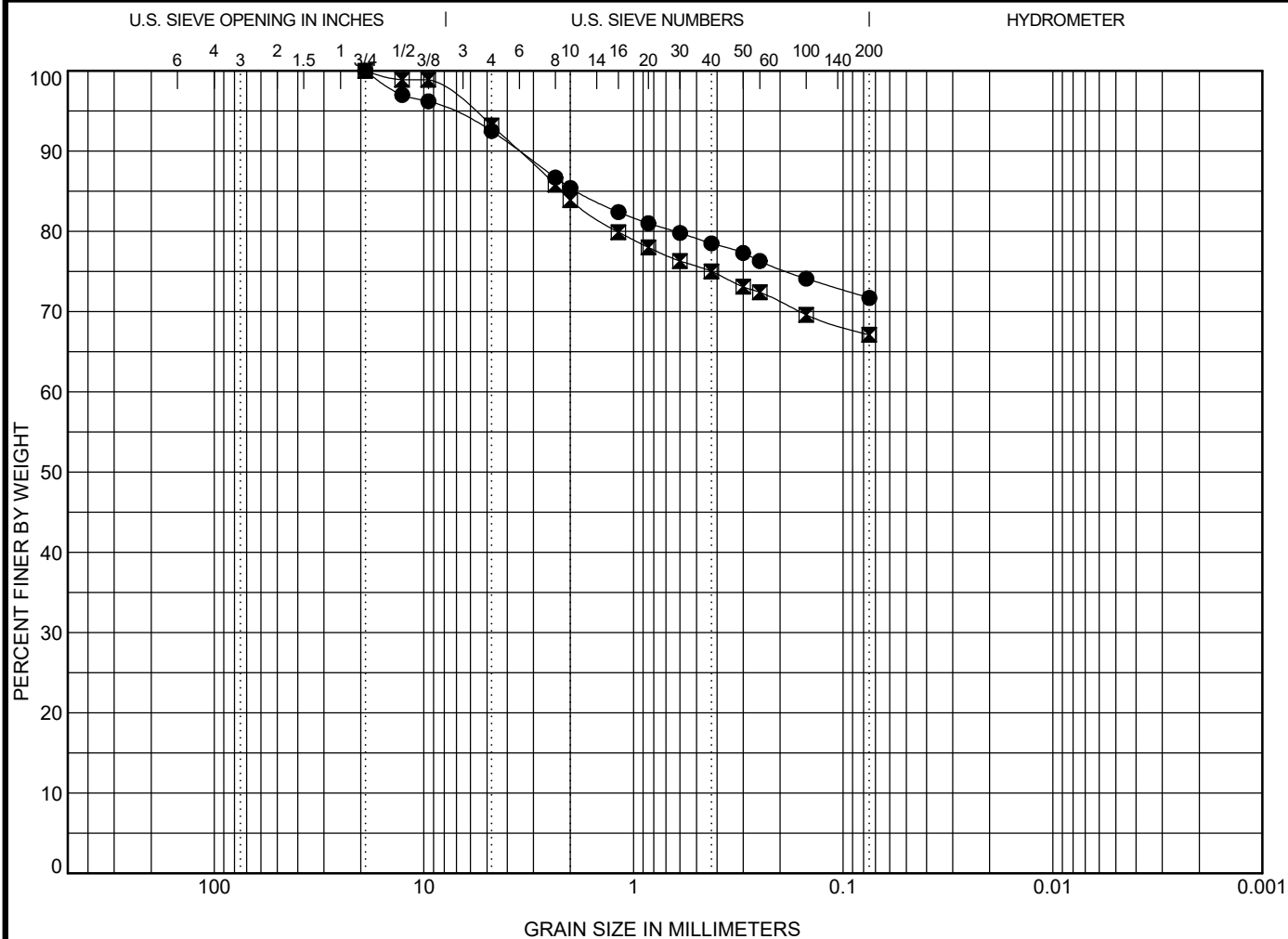
☒ Undisturbed Sample
 LA Lab Analysis

▼ Water Level
 ▽ Water Level 11.8' AFTER 1 HOUR
 — Boring Caved 13.2' AFTER 1 HOUR

CARMICHAEL
 ENGINEERING, INC.

TEST BORING LOG

JOB NO. G22-6518
 BORING NO. B-3
 DATE DRILLED 4/28/22
 TYPE BORING SB



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

[illegible][illegible]

Client: Seay, Seay, & Litchfield
1115 S. Court Street
Montgomery, AL 36104

Test Methods: ASTM D422, ASTM D4318
Sample Received Date: 4/28/2022
Test Date(s): Grain Size - 5/5/2022, Atterberg Limits - 5/5/2022



CARMICHAEL
ENGINEERING, INC.

650 Oliver Road
Montgomery, Alabama 36117

GRAIN SIZE DISTRIBUTION

Project: 117th Air National Guard GASNT Storage-Building 30

Location: Birmingham, AL

Job No.: G22-6518

Report Date: 5/10/2022

Reviewed By: Brandon M. Rountree, P.E.

INVESTIGATIVE FIELD PROCEDURES

Penetration Testing & Split Barrel Sampling: A standard 2.0" O.D. (1.4" I.D.) split barrel sampler is first seated 6" to penetrate any loose cuttings and then driven an additional 12" with blows of a 140-pound hammer falling 30". The number of blows required to drive the sampler the final foot is recorded and designated the "penetration resistance" (N). (ASTM D- 1586)

Soil Boring (SB): The test bore is advanced by a drilling rig utilizing 5-5/8" O.D. (2-1/4" I.D.) hollow stem augers. Soil samples are obtained with a standard split-tube sampler by driving the sampler thru the hollow auger. Collected soil specimens are sealed in air tight containers and delivered to the laboratory to confirm the drillers classifications. (ASTM D- 1452 & 1586)

Auger Boring (AB): Steel flight augers are utilized to advance the test bore. The soils are visually classified and sampled from the cuttings which are brought to the surface. (ASTM D-1452)

Undisturbed Sampling (UD): Relatively undisturbed soil samples are obtained by forcing a section of 3" O.D. 16-gauge steel tubing into the soil at the desired sample location. The tube is then sealed from moisture loss and delivered to the laboratory for possible laboratory testing.

Rotary-Wash Boring (RB): The drilling operation is performed by first setting a length of casing and then advancing the test bore by "jetting" a bentonite solution thru drill rods and bit.

Core Drilling (CD): The test bore is advanced thru rock by coring which utilizes a diamond bit and a double tube, swivel type core barrel. (ASTM D-2113)

Monitoring Wells (MW): Temporary or permanent wells may be installed to provide the accurate water table determination and periodic monitoring. The well is constructed with 1.5" to 4" diameter PVC pipe meeting current standards for monitoring well construction.



NOTES AND REFERENCES

Soil descriptions are based on the predominate constituent of the material and are further described by appropriate modifiers in reverse order of their importance. For example, a predominate sand soil containing clay would be described as “clayey sand”. Additional modifiers may be used, beginning with the least important constituent such as “silty clayey sand”, etc.

Water levels shown on the test boring logs reflect those levels measured at the specified time and date indicated on the logs. These water levels are subject to seasonal fluctuation and can be effected by local surface drainage and/or rainfall during the monitoring period.

The following table describes soil relative densities and consistencies based on penetration resistance values (N) determined by the Standard Penetration Test. The “N” values are estimated for hand tool bores using a portable dynamic cone penetrometer.

	N	Relative Density
Sand	0 – 3	Very Loose
	4 – 9	Loose
	10 – 19	Firm
	20 - 29	Very Firm
	30 - 49	Dense
	50+	Very Dense
	N	Consistency
Clay and Silt	0 - 2	Very Soft
	3 - 5	Soft
	6 - 11	Firm
	12 - 17	Stiff
	18 - 29	Very Stiff
	30 - 49	Hard
	50+	Very Hard


Laboratory Test References

Test	Reference
Moisture Content.....	ASTM D-854
Particle Size Analysis.....	ASTM D-421,422,1140
Atterberg Limit.....	ASTM D-423, 424
Specific Gravity.....	ASTM D-2216
Compaction Test.....	ASTM D-698, 1557
California Bearing Ratio Test.....	AASHTO T-193
Triaxial Shear Test.....	ASTM D-2850
Unconfined Compression Test.....	ASTM D-2166
Consolidation Test.....	ASTM D-2435
Soil Permeability Test.....	ASTM D-2434



The Unified Soil Classification System

Major divisions			Group symbol	Typical names	Classification criteria for coarse-grained soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u \geq 4$ $1 \leq C_c \leq 3$		
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW ($C_u < 4$ or $1 > C_c > 3$)		
			GM	d/u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $I_p < 4$	Above A line with $4 < I_p < 7$ are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below A line with $I_p > 7$		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u \geq 6$ $1 \leq C_c \leq 3$		
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW ($C_u < 6$ or $1 > C_c > 3$)		
			SM	d/u	Silty sands, sand-silt mixtures	Atterberg limits below A line or $I_p < 4$	Limits plotting in hatched zone with $4 \leq I_p \leq 7$ are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above A line with $I_p > 7$		
Fine-grained soils (more than half of material is smaller than No. 200)	Silts and clays (liquid limit < 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain-size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5%-GW, GP, SW, SP More than 12%-GM, GC, SM, SC 5 to 12%-Borderline cases requiring dual symbols.			
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
		OL	Organic silts and organic silty clays of low plasticity				
	Silts and clays (liquid limit > 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	$C_u = D_{60}/D_{10}$ $C_c = D_{30}^2/D_{10}D_{60}$			
		CH	Inorganic clays or high plasticity, fat clays				
		OH	Organic clays of medium to high plasticity, organic silts				
	Highly organic soils	Pt	Peat and other highly organic soils				





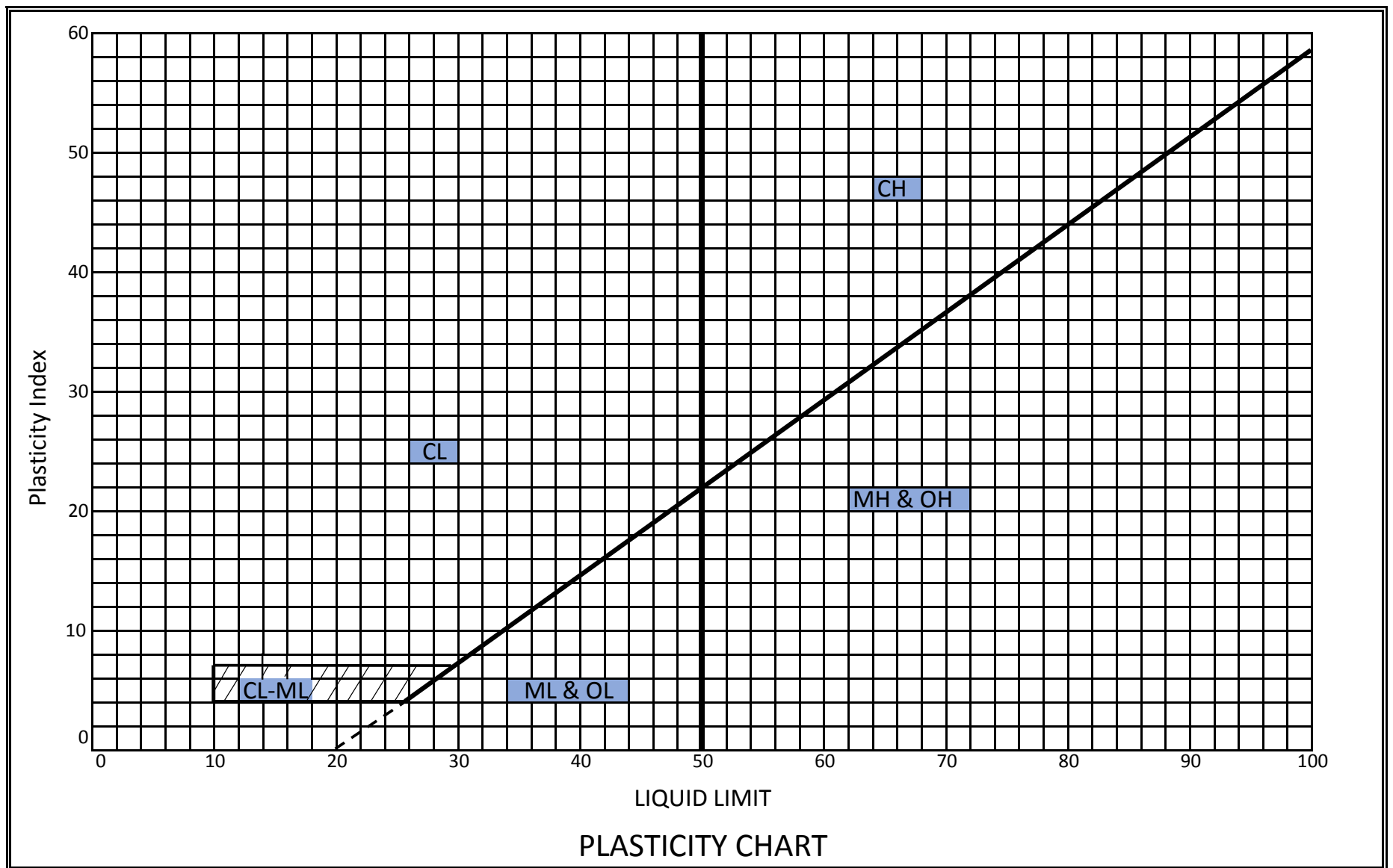


EXHIBIT C
CARMICHAEL ENGINEERING, INC.
GENERAL CONDITIONS OF AGREEMENT WITH THE CLIENT

1. **PAYMENT TERMS.** CARMICHAEL ENGINEERING, INC., (hereinafter called "CEI") will submit invoices to client monthly and a final bill upon completion of services. Invoice will show charges for different personnel, unit prices and/or expense classifications unless a lump sum payment is agreed to as part of this agreement. Payment is due upon presentation of invoice and is past due ten (10) days from the invoice date. Client agrees to pay a finance charge of one and one-half percent (1 1/2%) per month (minimum of \$15.00 per month) on the principal amount of any past due account. In the event CEI deems it necessary to refer the account to an attorney for collection, client agrees to pay all costs of collection, including a reasonable attorney's fee.
2. **INSURANCE.** CEI maintains Worker's Compensation and Employer's Liability Insurance in conformance with applicable state law. In addition, we maintain Comprehensive General Liability Insurance and Automobile Liability Insurance with bodily injury limits and property damage limits of, to wit \$1,000,000 combined single limit. A certificate of insurance can be supplied evidencing such coverage which contains a clause providing that fifteen (15) days written notice be given prior to cancellation. Cost of the above is included in our quoted fees. If additional coverage, such as additional insured endorsements, waiver of subrogation or increased limits of liability are required, CEI will endeavor to obtain the requested insurance and charge separately for costs associated with additional coverage or increased limits.
3. **STANDARD OF CARE.** The only warranty or guarantee made by CEI in connection with the services performed hereunder is that we will use that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended by our proposal for geotechnical/environmental services or by our furnishing oral or written reports.
4. **LIMITATION OF LIABILITY.** Client agrees to limit CEI's liability to client, and to all construction contractors and subcontractors on the project, arising from CEI's professional acts, errors or omissions or other professional negligence, so that the total aggregate liability of CEI to all those named shall not exceed \$100,000.
5. **RIGHT OF ENTRY.** Unless otherwise agreed in writing, client will provide for the right of entry for CEI, its agents and employees and all equipment necessary for the completion of the work. While CEI will take reasonable precautions to minimize any damage to the site, it is understood by the client that in the normal course of work some damage may occur and that the cost of correction or repairing such damage is not included in the quoted fee and CEI is not responsible unless specifically stated. If client desires CEI to repair or correct the damage, the cost of such repairs or corrections will be paid by client as an additional fee.
6. **EXISTING MAN MADE OBJECTS.** It is the duty of the client to disclose the presence and accurate location of all hidden or obscure man made objects, including utility lines, relative to field test or boring locations. CEI field personnel are trained to recognize clearly identifiable stakes or markings in the field and, without special written instructions to initiate field testing, drilling and/or sampling within a reasonable distance of each designated location. If CEI is notified in writing of the presence or potential presence of underground or above ground obstructions, such as utilities, CEI will give special instructions to its field personnel. Client agrees to indemnify and save harmless CEI from all claims, suits, losses, personal injuries, deaths and property liability resulting from unusual subsurface structures, owned by client or third parties, occurring in the performance of the proposed services, the presence and exact locations of which were not revealed to CEI in writing, and to reimburse CEI for expenses in connection with any such claims or suits, including reasonable attorney's fees.
7. **SAMPLING OR TESTING LOCATION.** The fees included in the Agreement do not include costs associated with surveying of the site or the accurate horizontal and vertical locations of tests. Field test or boring locations described in CEI's report or shown on sketches are based on specific information furnished by the client or client's agent or estimates made by CEI technicians. Such dimensions, depths or elevations should be considered as approximations unless otherwise stated in the report or contracted for at the inception of the Agreement.
8. **SAMPLE DISPOSAL AGREEMENT.** CEI will retain soil and rock samples which are not used for testing for forty-five (45) days after submission of our report. After forty-five (45) days the retained samples will be discarded unless the client has made written request for storage or transfer of the samples. Client shall be responsible for the expense of such storage or transfer.

9. SAFETY. When CEI provides periodic observations or monitoring services at the job site during construction, Client agrees that, in accordance with generally accepted construction practices, the contractor (i.e. not CEI) will be solely and completely responsible for working conditions on the job site, including safety of all persons and property during the performance of the work, and compliance with OSHA regulations, and that these requirements will apply continuously and not be limited to normal working hours. Any monitoring of the contractor's procedures conducted by CEI is not intended to include review of the adequacy of the contractor's safety measures in, on, adjacent to, or near the construction site.

10. ENGINEERING, EQUIPMENT AND TECHNICAL SERVICES. Fees for such services are based on all time spent on the project by engineering or technical personnel at the hourly or unit rates of the Fee Schedules. The quoted fee may not cover the cost of conferences, site visits, review of foundation plans and specifications, or other services subsequent to submission of our report. Such additional services will be invoiced at the applicable rates. All engineering and technical work is generally done by CEI's regular employees; however, special services by other firms or consultants may be needed on occasion and will be invoiced at the applicable rates but no "outside" services will be contracted for without clients prior permission.

11. ASSIGNMENT. Neither client or CEI may delegate, assign, sublet or transfer its duties or interest in this agreement without the prior written consent of the other party.

12. OWNERSHIP OF DOCUMENTS. All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates and other documents prepared by CEI, as instruments or service, shall remain the property of CEI. Client agrees that under no circumstances shall any documents or reports produced by CEI pursuant to this Agreement be used at any location or for any project not expressly provided for in this agreement without the written permission of CEI. Client agrees that all reports and other work furnished to client or its agents, which are not paid for, will be returned upon demand and will not be used by client for any purpose whatsoever. CEI will retain all pertinent written records relating to the services performed for a period of five (5) years following submission of the report, during which period the records will be made available to client at all reasonable times. During this five (5) year period, CEI will provide client with copies of documents created in the performance of the work, at the expense of client.

13. TERMINATION. This agreement may be terminated by either party upon fourteen (14) days written notice in the event of material failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if the material failure has been remedied before the expiration of the period specified in the written notice. In the event of termination, CEI shall be paid for all services performed and expenses incurred up to the termination notice data plus reasonable termination expenses. The expenses of termination or suspension shall include all direct costs or CEI in completing such analysis, records and reports.

14. GOVERNING LAW. This agreement shall be governed and construed in accordance with the laws of the State of Alabama, United States of America.

15. SEPARABILITY. The provisions of this agreement are separate and divisible, and, if any court of competent jurisdiction shall determine that any provision hereof is void and/or unenforceable, the remaining provisions shall be construed and shall be valid as if the void and/or unenforceable provisions or were not included in this Agreement.

16. WAIVER. Except as otherwise especially provided in this Agreement, no failure on the part of either party to exercise, and no delay in exercising, any rights, privilege or power under this Agreement shall operate as a waiver or relinquishment thereof, nor shall any single partial exercise by either party or any right, privilege or power under this Agreement preclude any other or further exercise thereof, or the exercise of any right, privilege or power. Waiver by any party of any breach of any provisions of the Agreement shall not constitute or be construed as a continuing waiver, or a waiver of any other breach of any provision of this Agreement.

17. BINDING. This agreement shall be binding upon all of the parties and their respective estates, heirs, administrators, executors, successors and assigns.

18. STIPULATION. Each of the parties to this Agreement as set forth herein and in the Work Order furnished by CEI stipulates that they have read, understand and agree to be bound by all of the terms set forth pursuant to the documents which are the basis of this agreement.

(Revised 1/1/09)

SECTION 32 1314 - CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Equipment Pads.
 - 2. Vehicular pavement.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earthwork" for subgrade preparation and grading.
 - 2. Division 32 Section "Pavement Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
 - 3. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or adhesive.
8. Joint fillers.

E. Sustainability Submittals:

1. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
 - a. Include statement indicating costs (sell price for each product having recycled content)
 - b. Include total weight of products provided
2. If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
3. Submit documentation for harvesting and manufacturing locations of all concrete and reinforcing steel intended for use on the project.
4. Provide documentation for pre and post-consumer recycled content for all concrete and reinforcing steel intended for use.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.06 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.07 SUSTAINABILITY REQUIREMENTS

A. Steel Reinforcing:

1. All reinforcing steel shall be from manufacturer(s) who fabricate and manufacturer products within 500 miles of the project site. Provide documentation as outline in Part I of this specification.
2. Contract shall endeavor to provide reinforcing steel with the highest percentages of pre and post-consumer recycled content readily available from manufacturer(s) who comply with requirements for regional materials listed above.
 - a. Minimum post-consumer recycled content = 85%
 - b. Minimum pre-consumer recycled content = 13%

B. Concrete Materials:

1. All concrete materials shall be from manufacturer(s) who fabricate and manufacturer products within 500 miles of the project site. Provide documentation as outline in Part I of this specification.
2. Contract shall endeavor to provide concrete materials with the highest percentages of pre and post-consumer recycled content readily available from manufacturer(s) who comply with requirements for regional materials listed above.

PART 2 PRODUCTS

2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A615, Grade 60.

2.03 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
 - 1. Fly Ash: ASTM C 618, Class F or C.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
 - 1. Maximum Aggregate Size: $\frac{3}{4}$ inch nominal.
 - 2. Do not use fine or coarse aggregates containing substances that cause spalling.
 - 3. Match existing aggregate to the extent possible.
- D. Water: ASTM C 94.
- E. All products (cement and aggregate combined), required a Solar Reflectance Index (SRI) of at least 29 calculated using ASTM E1980, "Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces."

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.

2.05 FIBER REINFORCEMENT

- A. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, ½ to 1-1/2 inches long.

2.06 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.07 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.08 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi for vehicular pavement, 3000 psi for all others.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 4. Slump Limit: 4 inches.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
 - 1. Air Content: 6.0 percent for $\frac{3}{4}$ inch maximum aggregate.
- F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 deg F and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 PREPARATION

- A. Proof-roll prepared subgrade surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Remove loose material from compacted subgrade surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
 - 1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 3. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting building, concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler less than ½ inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: $\frac{1}{4}$ inch.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: $\frac{1}{4}$ inch.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subgrade surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subgrade to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by the Government.
- I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.
- J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine- Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.07 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: $\frac{1}{4}$ inch.
 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 6. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:
 1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.

5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but not less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 8. When total quantity of a given class of concrete is less than 50 cu. yd., the Government may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
 10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to the Government, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Government but will not be used as the sole basis for approval or rejection.
- E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicated slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by the Government. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by the Government when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Beneficial Occupancy inspections.

END OF SECTION

SECTION 32 1720 - PAVEMENT JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including requirements of the Government's Solicitation and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within portland cement concrete pavement.
 - 2. Joints between portland cement concrete and asphalt pavement.
- B. Related Sections include the following:
 - 1. Division 32 Section "Cement Concrete Pavement" for constructing joints in concrete paving.
 - 2. Division 7 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.03 SUBMITTALS

- A. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by the Government from manufacturer's full range for this characteristic.

2.02 JOINT SEALANTS

- A. Single-Component, self leveling, silicone material that cures to an ultra-low modulus silicone rubber upon exposure to atmospheric moisture:
- B. Approvals:
 - 1. ASTM D5893 Type SL
 - 2. FAA P-605

3. SS-S-200E Flame Test Requirments
 4. EN 14187-5 Hydrolysis Test
 5. EN 14188-2 Class B, C, & D
- C. Product Technical Data:
1. Passes ASTM C 639, Flow
 2. Extrusion Rate, Minimum: 231 mL/min per ASTM C 1183
 3. Passes ASTM C679, Tack Free Time
 4. 0.97% loss per ASTM C 792, Heat Aging
 5. ASTM C 661, Durometer Shore 00: 41
 6. Passes ASTM D 1475
 7. 1400% Elongation per ASTM D412
 8. 9 psi Tensile Stress @150% per ASTM D 412
 9. Passes ASTM C 793, Effects of Accelerate Weathering
 10. 77% Resilience per ASTM C 793
 11. No Failure, ASTM C 719, Joint Movement Capability, +100/-50 percent ,10 cycles.

2.03 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.04 PRIMERS

- A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.

- 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Beneficial Occupancy. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

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SECTION 33 1117 - OUTSIDE WATER SYSTEM

GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including requirements of the Government's Solicitation and Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of water systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-31 section "Earthwork" for excavation and backfill required for water systems; not work of this section.
- C. Refer to Division-22 section "Plumbing" for interior building systems including interior piping, fixtures, and equipment; not work of this section.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with water piping work similar to that required for project.

1.04 CODES AND STANDARDS:

- A. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of water system materials and products.
- B. Water Purveyor Compliance: Comply with requirements of the Birmingham Water Works Board. Obtain required permits and inspections.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for water system materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed water system piping and products, in accordance with requirements of Division 1.

1.06 PROJECT CONDITIONS:

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.
- C. Notify the Government not less than two days in advance of proposed utility interruptions.
- D. Do not proceed with utility interruptions without the Government's written permission.

PART 2 - PRODUCTS

2.01 PIPES AND PIPE FITTINGS:

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections
- B. Piping: Provide pipe of the following material, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
- C. Pipe and Fittings:
 - 1. Copper Tubing: ASTM B88, seamless water tube, Annealed temper, Type K with soldered joints.
 - 2. PVC Plastic Pipe: ASTM D1785, with marking "NSF-pw" according to NSF 14.

2.02 PVC GATE VALVES:

- A. Body Material: High impact polyvinyl Chloride PVC. Furnish with hand-wheels and flanged joints for use in pits and cast iron valve boxes and covers where valves occur underground.

2.03 VALVE BOXES:

- A. Cast-iron box with top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

2.04 CONCRETE:

- A. All concrete including but not limited to thrust blocking, dead men, etc. shall have a 28 day compression strength of not less than 3000 pounds per square inch.

2.05 GRAVEL:

- A. Gravel for drainage shall be washed 3/4 inch crushed rock or graded river gravel and shall be free of organic matter, sand, loam, clay and other particles that will tend to restrict water flow through the gravel.

2.06 PIPE SLEEVES:

- A. Provide cast-iron or zinc coated sleeves built in place where water lines pass through walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve.

PART 3 - EXECUTION:

3.01 INSTALLATION OF PIPE AND PIPE FITTINGS:

- A. During installation of water lines the Contractor will be required to conduct his operations in a safety conscious manner. The Contractor shall comply with all applicable safety requirements in the location of the construction area. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.

3.02 SUPERVISION OF WORK:

- A. All work in progress shall receive the personal attention either of the Contractor or of a competent and reliable superintendent who shall have a full or final authority to act for him.

3.03 AUTHORITY AND DUTIES OF INSPECTOR:

- A. The Governing Authority Inspector shall be authorized to inspect all work done and all material furnished, including preparation, fabrication and manufacture of the materials to be used. The Inspector shall not be authorized to alter or waive any requirements of the specifications without consent of the Government. He shall call the attention of the Contractor to any failure of the work or materials to conform to the specifications. He may reject material or suspend the work until any questions at issue can be referred to and decided by the proper authority. The presence of the Inspector shall in no wise lessen the responsibility of the Contractor.

3.04 TRENCHES:

A. Water mains shall have at least 30 inches and not more than 48 inches of cover over the top of the pipe. Trenches shall be widened and deepened at all points where joints occur to such extent as to facilitate the proper making, tightening, and inspection of joints. The bottom of the trench shall be so shaped that except at "bell holes" the pipe, where laid, shall have a substantially uniform bearing throughout its length.

B. The maximum width of trench ditches shall be as follows:

<u>Main Size</u>	<u>Width</u>
Laterals	As small width as possible
2"	18"
6"	24"
1. 8"	30"

C. If an unstable trench bottom is encountered, the trench shall be undercut 4 to 6 inches and a suitable select granular material used to stabilize the trench bottom.

D. The trenching and pipe laying shall be done in an orderly fashion and in a workman like manner. Excessive water shall be pumped from the trench before the pipe is laid. Back of curb, intersections, and locations where the gate valves will be set, shall be staked before the main is laid.

E. Pipe shall be handled in such a manner as to protect the lining and the pipe from being damaged. It should NOT be dropped while unloading or while being installed in the trench. The Inspector has the right to reject any damaged material.

F. The pipe shall be kept clean of dirt, clods, and debris, etc., while being installed. It shall be properly plugged off at the end of the working day or when work is suspended to prevent the entrances of foreign materials (i.e., storm water, dirt, animal, etc.).

G. Pipe shall be laid true to line and grade except that it may be deflected within the limits of the manufacturer's recommendations for making necessary changes in direction.

H. Water mains when laid shall have a minimum vertical clearance of 12 inches from other mains, laterals, pipes or other obstructions.

3.05 VALVES:

A. Valves shall be set level on compacted earth made according to the manufacturer's recommendations.

- B. Valve boxes shall be set to be flush with the finish grade of a street or road.

3.06 FIELD QUALITY CONTROL:

- A. Before being pressure tested, all lines shall be thoroughly flushed to remove all debris, etc., that may be in the new main.
- B. Lines shall be flushed to achieve a velocity of 2 feet per second.
- C. All valves not required to be closed for isolation of the new line to be tested shall be open during the testing.
- D. After backfilling, all pipes shall be subjected to a hydrostatic test pressure of not less than 150 pounds per square inch by a pressure gauge.
- E. All visible leaks, when pressure is applied, shall be repaired and any pipe valve or fittings which when under the pressure test are found defective shall be replaced.
- F. The section of pipe tested shall be held at 150 psi for a minimum of 2 hours.
- G. Leakage of water shall not be greater than 25 gallons per 24 hours per inch of diameter per mile of pipe.
- H. The contractor shall provide all water, labor and material necessary for conducting the pressure test.
- I. Upon successful passing of the pressure test, the lines shall be chlorinated as directed by the Birmingham Water Works Board requirements. In the absence of prevailing code follow AWWA C651. The contractor will be responsible for the cost of chlorination and water used during construction and testing.

END OF SECTION

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