CUI

ATTENTION

Use this space to indicate categories, limited dissemination controls, special instructions, points of contact, etc., if needed.

Materials shall be submitted to potential offerors currently certified in the Joint Certification Program (JCP) only.

Controlled by: USACE
Controlled by: Louisville District
CUI Category(ies): General Critical Infrastucture Information
Distribution/Dissemination Control: FEDCON
POC: Alexa Dukes Contracting Specialist
alexa.l.dukes@usace.army.mil
502.315.3000

ATTENTION

All individuals handling this information are required to protect it from unauthorized disclosure.

Handling, storage, reproduction, and disposition of the attached document(s) must be in accordance with 32 CFR Part 2002 and applicable agency policy.

Access to and dissemination of Controlled Unclassified Information shall be allowed as necessary and permissible to any individual(s), organization(s), or grouping(s) of users, provided such access or dissemination is consistent with or in furtherance of a Lawful Government Purpose and in a manner consistent with applicable law, regulations, and Government-wide policies.

Standard Form 901 (11-18)
Prescribed by GSA/ISOO | 32 CFR 2002

CUI

US Army Corps
of Engineers
Louisville District

Solicitation For

Controlled Unclassified Information (CUI)

F/10856 - Replace AHU 5, WPAFB, OH

P2: 469978

Design-Bid-Build

Specifications
Corrected Final Submittal

28 February 2023
W912QR23R0022

ARIMS: 200A
Disposition: Maintain for 15yrs after construction

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO. W912QR23R0022	2. TYPE OF SOLICITATION ☐ SEALED BID (IFB) ☒ NEGOTIATED (RFP)	3. DATE ISSUED 28-Feb-2023	PAGE OF PAGES 1 OF 76

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.

7. ISSUED BY CODE W912QR	8. ADDRESS OFFER TO (If Other Than Item 7) CODE
U. S. ARMY ENGINEER DISTRICT, LOUISVILLE 600 DR. MARTIN LUTHER KING, JR. PLACE ROOM 821 LOUISVILLE KY 40202-2239 TEL: 502.315.7494 FAX:	**See Item 7** TEL: FAX:

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)
	ALEXA DUKES	502.315.3000

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date):*

Replace AHU-5 at WPAFB, OH.

Estimated Construction Cost is between $5,000,000 and $10,000,000 Per FAR 36.204.

NAICS Code 238220. Size Standard $19,000,000. Please note that business size in the System for Award Management (SAM) is determined by the NAICS code. If the vendor size is not listed correctly for a particular NAICS code in SAM the business will be considered other than a small business.

This is a Full and open procurement. In accordance with Federal Acquisition Regulation 19.1307, this project requires the HUBZone 10% price evaluation.

AFARS 5132.702(a)(ii)(B): Funds are not presently available for this acquisition. No contract award will be made until appropriated funds are made available.

Central Contractor Registration and ORCA are now available through SAM, available at www.sam.gov. Offerors must comply with the requirements of 52.204-7, 52.204-8, 52.232-33, and any other CCR/ORCA requirements in this solicitation through SAM.

PLEASE NOTE: SAM is completely free of charge for both registrants and users.

PLEASE NOTE: Page numbering in this document may not be accurate.

11. The Contractor shall begin performance within 10 calendar days and complete it within 548 calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See* FAR 52.11-10 *.)*

12 A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? *(If "YES," indicate within how many calendar days after award in Item 12B.)* ☒ YES ☐ NO	12B. CALENDAR DAYS 10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 1 copies to perform the work required are due at the place specified in Item 8 by 01:00 PM *(hour)* local time 24 Mar 2023 *(date).* If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☐ is, ☒ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

SOLICITATION, OFFER, AND AWARD (Continued)

(Construction, Alteration, or Repair)

OFFER ***(Must be fully completed by offeror)***

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*		15. TELEPHONE NO. *(Include area code)*
		16. REMITTANCE ADDRESS *(Include only if different than Item 14)* **See Item 14**
CODE	FACILITY CODE	

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirements stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS	SEE SCHEDULE OF PRICES

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD ***(To be completed by Government)***

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)*	**ITEM**	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 2304(c) ☐ 41 U.S.C. 253(c)
26. ADMINISTERED BY CODE		27. PAYMENT WILL BE MADE BY: CODE

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

☐ 29. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*		31A. NAME OF CONTRACTING OFFICER *(Type or print)* TEL: EMAIL:
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY
		31C. AWARD DATE

Section 00 10 00 - Solicitation

SF 1442 BLOCK 10 CONTINUATION

The solicitation will be available on the web only. Faxed, telephoned, or mailed requests for this solicitation will not be honored. To download the solicitation for this project, contractors are required to register at the Federal Contract Opportunities website at SAM.gov. For a quick start guide use the following link:

https://sam.gov/content/entity-registration

Amendments will be available from the website by download only.

Technical inquiries and questions relating to the proposal procedures or bonds are to be submitted via Bidder Inquiry in ProjNet at http://projnet.org/projnet. Please see Section 00 21 00, ProjNet Instructions for further guidance.

Please see FAR 52.236-27 ALT 1 for Site Visit information.

The term bid and proposal are used interchangeably in industry and may be used interchangeably throughout this solicitation.

ADDITIONAL INFORMATION:
Central Contractor Registration and ORCA are now available through the System for Award Management (SAM), available at www.sam.gov. Offerors must comply with the requirements of 52.204-7, 52.232-33, and any other CCR/ORCA requirements in this solicitation through SAM.

PLEASE NOTE: SAM is completely free of charge for both registrants and users.

PRICE BREAKOUT SCHEDULE

PRICE BREAKOUT SCHEDULE

PROPOSER'S NAME: _____

Item	Description	Unit	Amount
BASE PROPOSAL			
0001	Building Renovations	Job	$ -
	Total Base Proposal		$ -
OPTIONS			
0002	Procure and Install FF&E	Job	$ -
	Total All Options		$ -
	Total Base Proposal with All Options		$ -

NOTES FOR PRICE BREAKOUT SCHEDULE

1. The company name should be indicated on the face of the Price Breakout Schedule to preclude being misplaced.
2. Proposers must insert a price on all numbered items (including options) of the Price Breakout Schedule. Failure to do so may result in the offer being unacceptable.
3. Description of Proposal Items - The general outline of the principal features of each item as listed below does not in any way limit the responsibility of the proposer for making a thorough investigation of the drawings and the specifications to determine the scope of work including each item of the Price Breakout Schedule.

DESCRIPTION OF BASE PROPOSAL ITEMS

a) Item No. 0001 – All work, labor, materials, and equipment required to complete the sustainment repair (EEIC 524) work and renovation and modernization (R&M) repair (EEIC 522) work for "Replace AHU-5" Project No. ZHTV160060 at Wright-Patterson Air Force Base, Ohio. Includes new air handler and distribution, all HVAC equipment and distribution, all demolition, new & reconfigured ceiling, all hazardous material abatement. Removal, re-location, storage cleaning, re-installation of existing furniture and associated Communications conduit and box rough-in connections. Includes all fire alarm and sprinkler work, all fire protection work, all partitions and walls work, all lighting work, all power and electrical work. Staging and laydown.

DESCRIPTION OF OPTION PROPOSAL ITEMS

a) Item No. 0002 (Option 1) – All work, labor, materials, and equipment required to procure and install the FF&E package.

NOTE: Line Item 0002 (Option 1): The Contracting Officer may exercise the option by written notice to the Contractor within 270 calendar days of Notice to Proceed.

-END OF PRICE BREAKOUT SCHEDULE—

Section 00 21 00 - Instructions

PROJNET INSTRUCTIONS

OFFEROR'S QUESTIONS AND COMMENTS

Technical inquiries and questions relating to proposal procedures or bonds are to be submitted via Bidder Inquiry in ProjNet at http://www.ProjNet.org/ProjNet. As noted below, offerors shall not submit their proposals via ProjNet. Offerors shall submit their proposals in accordance with the provisions stated in the solicitation.
To submit and review bid inquiry items, bidders will need to be a current registered user or selfregister into system.
The Solicitation Number is: **W912QR23R0022**
The Bidder Inquiry Key is: **X4T8AK-T7D6PV**
Specific Instructions for ProjNet Bid Inquiry Access:

1. From the ProjNet home page linked above, click on **Quick Add** on the upper right side of the screen.
2. Identify the Agency. This should be marked as **USACE**.
3. Key. Enter the **Bidder Inquiry Key** listed above.
4. Email. Enter the email address you would like to use for communication.
5. Select Continue. A page will then open stating a user account was not found and will ask you to create one using the provided form.
6. Enter your First Name, Last Name, Company, City, State, Phone, Email, Secret Question, Secret Answer, and Time Zone. Make sure to remember your Secret Question and Answer as they will be used from this point on to access the ProjNet system.
7. Select Add User. Once this is completed you are now registered within ProjNet and are currently logged into the system.

Specific Instructions for Future ProjNet Bid Inquiry Access:

1. For future access to ProjNet, you will not be emailed any type of password. You will utilize your Secret Question and Secret Answer to log in.
2. From the ProjNet home page linked above, click on **Quick Add** on the upper right side of the screen.
3. Identify the Agency. This should be marked as **USACE**.
4. Key. Enter the **Bidder Inquiry Key** listed above.
5. Email. Enter the email address you used to register previously in ProjNet.
6. Select Continue. A page will then open asking you to enter the answer to your SecretQuestion.
7. Enter your Secret Answer and click Login. Once this is completed you are now logged into the system.

From this page you may view all bidder inquiries or add an inquiry.
Bidders will receive an acknowledgement of their question via email, followed by an answer to their question after it has been processed by our technical team.
Offerors are requested to review the specification in its entirety and to review the Bidder Inquiry System for answers to questions prior to submission of a new inquiry.
The call center operates weekdays from 8AM to 5PM U.S. Central Time Zone (Chicago). The telephone number for the Call Center is 800-428-HELP.

Offers will NOT be publicly opened. Information concerning the status of the evaluation and/or award will NOT be available after receipt of proposals.

NOTES:

1. Offerors shall not submit their proposals via ProjNet, but in accordance with the provisions stated in the solicitation. Any questions regarding acceptable means of submitting offers shall be made directly to the Contract Specialist identified in the solicitation.
2. Government responses to technical inquiries and questions relating to proposal procedures or bonds that are submitted to ProjNet in accordance with the procedures above are not binding on the Government unless an amendment is issued on Standard Form 30. In the case of any conflicts, the solicitation governs. Any changes or revisions to the solicitation will be made by formal amendment. Government responses will be limited to: (a) Notice that an amendment will be issued; (b) Reference to an existing requirement contained in the solicitation; or (c) Notice that a response is not necessary.
3. The ability to enter technical inquiries and questions relating to proposal procedures or bonds will be disabled ten (10) calendar days prior to the closing date stated in the solicitation. No Government responses will be entered into the ProjNet system within five (5) calendar days prior to the closing date stated in the solicitation.

PROPOSAL SUBMISSION INSTRUCT

Proposals: ALL SUBMISSIONS TO THIS PROPOSAL ANNOUNCEMENT SHALL BE SUBMITTED ELECTRONICALLY THROUGH DOD SAFE. No paper copies, CD-ROMs or facsimile submissions will be accepted. Electronic Proposal Submission is required through the Army's Electronic File Sharing Service, DOD SAFE (https://safe.apps.mil). The DOD SAFE Application is used to send large files to individuals that would normally be too large to send via email. There are no user accounts for SAFE. Authentication is handled via email. Anyone has access to DOD SAFE, and the application is available for use by anyone. The SAFE "Getting Started Guide" has information on how to utilize the system (https://safe.apps.mil/about.php). Instructions for uploading are as follows:

1. Send an email to the Contracting Officer and Contract Specialist to receive the link to drop off your proposal. This will need to be completed five (5) business days prior to proposal due date.
    a. Alexa Dukes, Contract Specialist at Alexa.L.Dukes@usace.army.mil
    b. Patrick Duggins, Contracting Officer at Patrick.J.Duggins@usace.army.mil
2. You will receive an email with the link to submit your drop-off. The link will be provided no later than two (2) business days prior to the proposal due date.
3. Short Note to the Recipients: Click the Add Files or Drag and Drop your files. For file description, enter **W912QR23R0022-FIRMNAME.**
4. Click Upload button to send documents.
5. Guest users will need to check their email to verify their email address before the recipients will be notified. (Government-issued Common Access Cards (CACs) are not required).

File Size Limitations: Offerors are advised to follow the DOD SAFE instructions for uploading files. DOD SAFE supports delivery up to 8GB. If needed, Offerors are advised to break the files down into smaller sections in order to upload it to the system. In such cases, please divide the sections as logically as possible and be sure to clearly name the files as specified below.

File Naming Convention: To ensure your submission is received and processed appropriately, it is important that interested parties CAREFULLY ensure their electronic files adhere to the following naming convention:

- **W912QR23R0022-FIRMNAME-VOLUME I**
- **W912QR23R0022-FIRMNAME-VOLUME II**

Each file name shall begin with the solicitation number followed by the firm's name and a brief file description. Please see examples above.

File Organization: Although hard copies are not accepted, each file shall be clearly indexed, and logically assembled. Font size shall be 10 or larger. Pages shall be letter sized (larger page sizes (such as 11x17 fold-outs, etc.) will be counted as two pages. Proposals shall be in a narrative format, organized and titled so that each section of the proposal follows the order and format of the factors. Information presented should be organized so as to pertain to only the evaluation factor in the section that the information is presented. Information pertaining to more than one evaluation factor should be repeated in each section for each factor.

Upload Completion & Deadline: Interested parties shall submit responses no later than the date specified on the solicitation document. The time & date of proposal receipt will be the upload completion / delivery time & date recorded within DOD SAFE site. Do not assume that electronic submission will occur instantaneously. Large files (e.g. 10MB or more) will take some time to upload. Offerors should time their upload effort with prudence by not waiting until the last few minutes—this will allow for unexpected delays in the transmittal process. Offerors are encouraged to keep a copy of the upload confirmation for their record. Submissions after the deadline will be considered late and will be processed in accordance with FAR 15.208.

Electronic Files: Files shall be in their native format (i.e. doc, xls, ppt, etc.), or if in pdf format, shall be in searchable text. Text and graphics portfolios of the electronic copies shall be in a format readable by Microsoft Office or Adobe applications. Data submitted in a spreadsheet format shall be readable by MS Excel (all cells and formulas should be unlocked).

Any information, presented in a proposal that the Offeror wants safeguarded from disclosure to other parties must be identified and labeled in accordance with the requirements of Provision "FAR 52.215-1, Instructions to Offe`rors – Competitive Acquisition (Jan 2017)," subparagraph (e), which is found in 00 21 00 Instructions of the RFP. The Government will endeavor to honor the restrictions against release requested by Offerors, to the extent permitted under United States law and regulations.

CLAUSES INCORPORATED BY REFERENCE

52.204-7	System for Award Management	OCT 2018
52.204-16	Commercial and Government Entity Code Reporting	AUG 2020
52.204-22	Alternative Line Item Proposal	JAN 2017
52.211-7	Alternatives to Government-Unique Standards	NOV 1999
52.215-1	Instructions to Offerors--Competitive Acquisition	NOV 2021
52.217-5	Evaluation Of Options	JUL 1990
52.222-56	Certification Regarding Trafficking in Persons Compliance Plan.	OCT 2020
52.233-2	Service Of Protest	SEP 2006
252.215-7008	Only One Offer	DEC 2022
252.215-7013	Supplies and Services Provided by Nontraditional Defense Contractors	DEC 2022

CLAUSES INCORPORATED BY FULL TEXT

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a Firm Fixed Price contract resulting from this solicitation.

(End of provision)

52.222-5 CONSTRUCTION WAGE RATE REQUIREMENTS--SECONDARY SITE OF THE WORK (MAY 2014)

(a)(1) The offeror shall notify the Government if the offeror intends to perform work at any secondary site of the work, as defined in paragraph (a)(1)(ii) of the FAR clause at 52.222-6, Construction Wage Rate Requirements, of this solicitation.

(2) If the offeror is unsure if a planned work site satisfies the criteria for a secondary site of the work, the offeror shall request a determination from the Contracting Officer.

(b)(1) If the wage determination provided by the Government for work at the primary site of the work is not applicable to the secondary site of the work, the offeror shall request a wage determination from the Contracting Officer.

(2) The due date for receipt of offers will not be extended as a result of an offeror's request for a wage determination for a secondary site of the work.

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995) – ALTERNATE I (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) An organized site visit has been scheduled for--

09 March 2023

All attendees are required to meet at Pass and ID in Area A of WPAFB for In-Processing at 1130.

General Contractor will only be allowed to bring (4) people per their team to this site visit.

Schedule:
1200-1230: Registration for site visit (USACE will sponsor visitors for a (1) day base pass)
1230-1250: Bus will transport attendees to the site
1300-1600: Pre-Proposal Meeting

No inquiries will be allowed during the site visit. All inquiries must be submitted via the Projnet Bidder Inquiry site. A Bidder Key is provided with the solicitation information. Please RSVP the following information:

1. Name of Attendee
2. Company
3. Phone Number and Email Address
4. US Citizen Yes or NO
5. Do you have a Base Pass / Green CAC Card?
6. Driver License Number and State

Please remember to bring a Current State Issued ID in order to attend the site visit.

Send RSVP to John.P.Hearn@usace.army.mil, USACE must receive the email by 1300 hours EST. on 6 MAR 2023. No additional attendees will be registered after this date or time. A Confirmation email will be sent out by 8 MAR 2023, to confirm each registration. It will include driving instructions to WPAFB visitors center. We will also provide a base map and any other pertinent information.

NO ELECTRONIC DEVICES WILL BE PERMITTED ON THE SITE VISIT; To include, but not limited too: Cell Phones, Camera's or Tablets, Fit Bits, Key Fob's etc.

(End of provision)

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by

paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

https://www.acquisition.gov

The full text of a DFARS provision may be accessed electronically at this/these address(es):

https://www.acq.osd.mil/dpap/dars/dfarspgi/current/index.html

(End of provision)

52.252-5 AUTHORIZED DEVIATIONS IN PROVISIONS (NOV 2020)

(a) The use in this solicitation of any Federal Acquisition Regulation (48 CFR Chapter 1) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the provision.

(b) The use in this solicitation of any Defense Federal Acquisition Regulation (48 CFR Chapter 2) provision with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of provision)

Section 00 22 00 - Supplementary Instructions

EVALUATION CRITERIA

PROCEDURES FOR SUBMITTAL OF OFFERS AND PROPOSAL EVALUATION CRITERIA

1. **Overview.**

1.1 The intent of this solicitation is to select one contractor for Replace AHU-5 Project at Wright-Patterson Air Force Base, Dayton, OH. The basis of award is the Best Value Trade-Off process. The Government will evaluate the proposals in accordance with the criteria described herein. The Contracting Officer will award a firm fixed price contract to the responsible offeror whom the Source Selection Authority (SSA) determines conforms to the solicitation, is fair and reasonable, and offers the best overall value to the Government, all factors considered. The Government reserves the right to accept other than the lowest priced offer or to reject all offers.

1.2 This design/bid/build project involves the replacement of AHU-5 and associated mixing boxes; as well as ancillary work to improve working conditions throughout the building. Work includes modernization and reconfiguration of the office area (33,400 SF) by replacing and rearranging partitions, doors, frames, hardware, wall and floor finishes, lighting, electrical distribution, including conduit, conductor, outlets, and the communications system.

Project will comply with Intelligence Community Directive (ICD) 705 requirements, as well as standards Established in UFC-3-410-01 (HVAC Systems), UFC 3-401-01 (Mechanical Engineering), UFC 3-520-01 (Design, Interior Electric Systems), UFC 3-530-01 (Design, Interior & Exterior Lighting and Controls), NFPA 13 (Standard for the installation of sprinkler systems), NFPA 101 (Life Safety Code), NFPA 70 (National Electrical Code) and other relevant Air Force and industry standards as referenced in the Plans & Specifications, with applicable versions as of the 35% design date of 03 May 2019.

1.3 The target ceiling for contract award is $6,300,000.00 based on the funds made available for this project. The Government cannot guarantee that additional funds will be available for award. Offerors are under no obligation to approach this ceiling.

2. **Submittal of offers**.

2.1 Offerors submitting proposals for this project should limit submissions to data essential for evaluation of proposals so that a minimum of time and monies will have been expended in preparing information required herein. However, in order to be effectively and equitably evaluated, the proposals must include information sufficiently detailed to clearly describe the offeror's capability for successfully completing the solicited project. Requirements stated in this Request for Proposal (RFP) are minimums. Proposals should follow in the order of sequence set forth in the RFP. Information provided out of sequence may not be evaluated and may result in the offeror’s disqualification from award.

2.2 All offers in response to this solicitation shall be submitted electronically through DoD SAFE no later than the time and date specified in Block 13 of Standard Form 1442. Please refer to and follow the instructions specified in the Proposal Submission Instructions section of the solicitation.

2.3 Volume I shall be submitted electronically in accordance with the Proposal Submission Instructions in Section 00 21 00 and include the following information:

- Volume I – Factor I: Past Performance
- Volume I – Factor II: Management Approach

- Volume I – Factor III: Small Business Participation Plan

NOTE: Failure to place the required submission information under the appropriate tab (factor) may result in a lower rating if the evaluators cannot readily find the appropriate information. Any specified page limits will be strictly adhered to and enforced. Information submitted that exceeds the specified limit(s) will not be evaluated.

2.4. Volume II shall be submitted electronically in accordance with the Proposal Submission Instructions in Section 00 21 00 and include the following information:

- Volume II – Tab A: Standard Form 1442 and Price Breakout Schedule
- Volume II – Tab B: Joint Venture Agreements
- Volume II – Tab C: Evidence of Ability to Obtain Bonding and Proof of Financial Ability
- Volume II – Tab D: Pre-Award Information
- Volume II – Tab E: Subcontracting Plan

NOTE: Failure to place the required submission information under the appropriate tab (factor) may result in a lower rating if the evaluators cannot readily find the appropriate information.

3. **Proposal Evaluation Process**.

3.1. A Source Selection Evaluation Board (SSEB) comprised of representatives of the Corps of Engineers, User/Customer, and other required personnel will evaluate the proposals. Offerors are advised that the technical evaluation and rating of proposals will be conducted in strict confidence. Technical proposals (Volume I) will be reviewed and rated without knowledge of the price offered. The number and identities of offerors are not revealed to anyone not involved in the evaluation and award process or to other offerors. Proposals will be evaluated based on the factors described herein, and the basis of award is a Best Value Trade-Off, as stated in paragraph 1.1 above.

3.2 The evaluation process essentially consists of four parts: proposal compliance review and responsibility review, technical evaluation, price evaluation, and price/technical trade-off analysis.

3.2.1 Proposal Compliance/Responsibility Review: This is an initial review to ensure that all required forms and certifications are complete, that both a technical and price proposal were received, and that the offeror is financially capable of sustaining performance under the contract and is able to obtain the required level of performance and payment bonds from an acceptable surety.

3.2.2 Technical Evaluation: The SSEB will evaluate and rate the Volume I proposals against the RFP requirements. Factor I – Past Performance will be rated using Tables 1 and 2 below. The rating will be based on overall confidence in performance, with the final confidence assessment rating based on the extent of recent, relevant past experience and the quality of the offeror's performance. Factor II – Management Approach will be rated using Table 3 below. Factor III – Small Business Participation Plan will be rated using Table 4 below.

3.2.3 Price Evaluation: The SSEB and Contracting Officer/SSA will evaluate price proposals independent and subsequent of the technical evaluation. The SSEB will not have access to price information until completion of the technical evaluation.

3.2.4 Comparative Analysis: After all above evaluations are complete, the Contracting Officer/SSA will compare the relative advantages and disadvantages of technical proposals and compare prices. The Source Selection Authority (SSA) will then consider all factors to select the proposal offering the best value to the Government.

4. **Proposal Information and Related Evaluation Factors.**

4.1 Proposals will be evaluated in accordance with the factors and below, listed in relative order of importance. **All evaluation factors, other than price, when combined are considered approximately equal to price.** The Government intends to evaluate proposals and award a contract without discussions with offerors in accordance with FAR 15.306(a). Therefore, the offeror's initial proposal should contain the offeror's best terms from a price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

4.2	Volume I – Factor I – Past Performance	1st
4.3	Volume I – Factor II – Management Approach	2nd
4.4	Volume I – Factor III – Small Business Participation Plan	3rd
4.5	Volume II - Price and Pro Forma Information	

Tab A	Standard Form 1442 and Price Breakout Schedule	Not Rated
Tab B	Joint Venture Agreement	Not Rated
Tab C	Evidence of Ability to Obtain Bonding and Proof of Financial Ability	Not Rated
Tab D	Pre-Award Information	Not Rated
Tab E	Subcontracting Plan	Acceptable / Unacceptable

4.6 Ratings

Evaluators will apply the l rating for the definition that most closely matches the evaluation.

Table 1

Past Performance Relevancy Ratings	
Rating	**Description**
Very Relevant	Present/past performance effort involved essentially the same scope and magnitude of effort and complexities this solicitation requires.
Relevant	Present/past performance effort involved similar scope and magnitude of effort and complexities this solicitation requires.
Somewhat Relevant	Present/past performance effort involved some of the scope and magnitude of effort and complexities this solicitation requires.
Not Relevant	Present/past performance effort involved little or none of the scope and magnitude of effort and complexities this solicitation requires.

Table 2

Performance Confidence Assessments	
Rating	**Description**
Substantial Confidence	Based on the offeror's recent/relevant performance record, the Government has a high expectation that the offeror will successfully perform the required effort.
Satisfactory Confidence	Based on the offeror's recent/relevant performance record, the Government has a reasonable expectation that the offeror will successfully perform the required effort.
Neutral Confidence	No recent/relevant performance record is available or the offeror's performance record is so sparse that no meaningful confidence assessment rating can be reasonably assigned. The offeror may not be evaluated favorably or unfavorably on the factor of past performance.
Limited Confidence	Based on the offeror's recent/relevant performance record, the Government has a low expectation that the offeror will successfully perform the required effort.
No Confidence	Based on the offeror's recent/relevant performance record, the Government has no expectation that the offeror will successfully perform the required effort.

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Table 3

Technical/Risk Assessment Ratings	
Adjectival Rating	**Description**
Outstanding	Proposal indicates an exceptional approach and understanding of the requirements and contains multiple strengths and/or at least one significant strength, and risk of unsuccessful performance is low.
Good	Proposal indicates a thorough approach and understanding of the requirements and contains at least one strength or significant strength, and risk of unsuccessful performance is low to moderate.
Acceptable	Proposal meets requirements and indicates an adequate approach and understanding of the requirements, and risk of unsuccessful performance is no worse than moderate.
Marginal	Proposal has not demonstrated an adequate approach and understanding of the requirements, and/or risk of unsuccessful performance is high.
Unacceptable	Proposal does not meet requirements of the solicitation and, thus, contains one or more deficiencies and is unawardable, and/or risk of performance is unacceptably high.

Table 4

Small Business Ratings	
Rating	**Description**
Acceptable	Proposal indicates an adequate approach and understanding of small business objectives.
Unacceptable	Proposal does not meet small business objectives

4.7 Definitions

1. Deficiency. A material failure of a proposal to meet a Government requirement or a combination of significant weaknesses in a proposal that increases the risk of unsuccessful contract performance to an unacceptable level. See FAR 15.001.

2. Strength. An aspect of an offeror's proposal with merit or will exceed specified performance or capability requirements to the advantage of the Government during contract performance.

3. Significant Strength. An aspect of an offeror's proposal with appreciable merit or will exceed specified performance or capability requirements to the considerable advantage of the Government during contract performance.

4. Weakness. A flaw in the proposal that increases the risk of unsuccessful contract performance. See FAR 15.001.

5. Significant Weakness. A flaw in the proposal that appreciably increases the risk of unsuccessful contract performance. See FAR 15.001.

6. Uncertainty. Any aspect of a non-cost/price factor proposal for which the intent of the offeror is unclear (e.g., more than one way to interpret the offer or inconsistencies in the proposal indicating that there may have been an error, omission or mistake).

7. Clarification. Limited exchanges between the Government and offerors that may occur when award without discussions is contemplated. See FAR 15.306(a)(1).

8. Adverse Past Performance. Past performance information that supports a less than satisfactory rating from sources where the information is from other than formal rating systems such as "CPARS" or "FAPIIS."

5.0 **Volume I – Factor I: Past Performance**

5.1 Submission Requirements:

5.1.1 Provide descriptions of up to three (3) projects substantially complete or completed by the prime contractor within the last five (5) years (from the solicitation closing date) which are similar to this project in size and scope. Projects completed more than five (5) years before the solicitation closing date may considered for evaluation purposes but may lessen the overall relevancy rating for the project. Projects are considered substantially complete if enough work has been performed such that it demonstrates the ability to successfully complete all phases of the project. An IDIQ contract may be submitted only if a single task order could be considered similar to this project. Task orders may not be combined in order for the project to be considered similar.

5.1.2 Projects considered similar in size would be a minimum of 28,500 CFM air handler and associated mechanical equipment replacement and renovation of at least 15,000 sq. ft. interior secure, ICD 705-compliant space.

5.1.3 Projects considered similar in scope to this project include replacement of air handler, controls, and infrastructure system renovations, asbestos abatement, chiller distribution systems with associated controls, and interior renovation of secure, ICD 705-compliant facilities.

5.1.4 The prime contractor must have self-performed at least 15 percent of the direct contract labor (including testing and layout personnel), exclusive of other general conditions or field overhead personnel, material, equipment, or subcontractors to be considered similar.

5.1.5 Additional consideration may be given for projects that contain the following features:

a) Experience working within secured and classified facilities at Wright-Patterson Air Force Base.
b) Experience working with United States Army Corps of Engineers' projects.

5.1.6 The following information shall be provided for each project:

a) Project Title, Location, and Contract Number/Unique Identifier
b) Current percentage of construction complete and the date it was or will be complete
    a. For projects that are not yet complete, provide description of work remaining to be completed.
c) Scope of the project, to include purpose/use of facility
d) Size of the project, differentiate square footage of new construction versus renovation if the project includes both
e) Type and percentage of work that was self-performed

5.1.7 For this factor, also include any ratings, letters, awards, etc. that support past performance on these projects. Any of this information that is submitted shall clearly identify to which of the submitted projects it pertains. A sample Past Performance Questionnaire is attached for your convenience. If used, the Past Performance Questionnaire must be submitted by the offeror with the proposal submission and **not** sent directly to the agency from the reference. For each project, the offeror may provide information on problems encountered on the identified contracts and the offeror's respective corrective action.

NOTE: For purposes of evaluating past performance, the Prime Contractor is defined as the contractor identified in Block 14 of the Standard Form 1442. Projects performed by contractors other than the offeror, including, but not limited to, teaming partners, subcontractors, sister or parent companies, and affiliates will not be evaluated for past performance, unless those other contractors are part of a joint venture offeror as demonstrated by a signed joint venture agreement. If more than one contractor is listed in Block 14, then a signed joint venture must be submitted with the proposal and the joint venture shall be registered as such in the System for Award Management (SAM). However, each party of the Joint Venture (JV) must submit their own Unique Entity Identifier Number (formerly known as DUNS) with the JV proposal. Projects performed by other contractors than the offeror, such as teaming partners or subcontractors, will not be evaluated for past performance, unless those other contractors are part of a JV offeror as demonstrated by a signed JV agreement. If the offeror represents the combining of two or more companies as a JV for the purpose of this RFP, each company in the JV may submit project examples, but the total submitted by the JV will not exceed three (3).

5.2 Evaluation Criteria:

5.2.1 The SSEB will first evaluate the relevancy of recent past performance identified in the proposal in response to paragraph 5.1 above. By using the criteria identified above, the SSEB will determine how relevant a past project is when compared to the scope, size, and magnitude of effort and complexities of the solicited project. A relevancy rating will be assigned to each submitted project using the Past Performance Relevancy Ratings table above.

5.2.2 The SSEB will next review how well the offeror performed on those projects. The Government reserves the right to check any or all cited references to verify supplied information and to assess owner satisfaction. The Government also reserves the right to not contact the provided references. In addition to the information submitted by the offeror, the Government reserves the right to review any other sources of relevant information for evaluating past performance, including projects other than those submitted by the offeror. The Government reserves the right to review past performance information retrieved through the Past Performance Information Retrieval System (PPIRS), including Contractor Performance Assessment Reporting System (CPARS), using all CAGE/Unique Entity Identifier numbers. Other sources may include, but are not limited to, past performance information retrieved from inquiries of owner representative(s), Federal Awardee Performance and Integrity Information System (FAPIIS), Electronic Subcontract Reporting System (eSRS), and any other known sources not provided by the offeror.

5.2.3 The SSEB will review all past performance information collected and determine the quality of the offeror's performance, general trends, and usefulness of the information and incorporate this information into the performance confidence assessment. The SSEB will assign a final, overall Performance Confidence rating, using the ratings in the Performance Confidence Assessment table, Table 2, above, based on the SSEB's assessment of (1) the degree of the offeror's recent, relevant experience, and (2) how well the offeror performed that experience.

6.0 **Volume I – Factor II: Management Approach**

6.1 Management Approach:

6.1.1 **Submission Requirements:**

Provide a management approach narrative for the project that describes how your labor, resources, designers, subcontractors, and material suppliers will be managed, supervised, coordinated, and used to ensure successful completion of the project. Additionally, the Management Approach shall include the following information:

- Identify significant areas of risk and provide your plan for mitigating risk during contract performance.

- Describe your process for managing, coordinating, and tracking changes that arise during construction.

- Describe how you will manage, supervise and coordinate the sub-contractors work and name who in the organization will be responsible for this management and coordination. Discuss which resources are available but will not be present at the site.

- Describe the process for coordinating with existing, ongoing building functions and personnel. Narrative should reference how construction activities (utility service interruptions, construction parking/bed-down areas, escorting requirements, etc.) will be integrated into the project to ensure minimal impact to ongoing building operations.

NOTE: There is a page limit of five (5) single sided, 8.5" x 11" pages, using a minimum font size of 10 and a minimum margin of one-half inch on all sides for the Management Approach.

6.1.2 Evaluation Criteria:

Management Approach narratives will be evaluated based on the level of understanding of the work and the involvement the contractor will have in the management, oversight, control, and coordination of the work performed during construction of the project. Narratives that demonstrate a clear understanding of the project requirements and provide a thorough approach for successfully managing the solicited project may be rated more favorably by the SSEB in accordance with Table 3, Technical/Risk Assessment Rating.

7.0 **Volume I – Factor III: Small Business Participation Plan**

7.1 Submission Requirements

ALL OFFERORS ARE REQUIRED TO SUBMIT A SMALL BUSINESS PARTICIPATION PLAN. The Small Business Participation Plan shall be based on the offeror's best effort and is required to address each of the following areas individually:

- The extent to which the small business programs listed in FAR 19 (small business, small disadvantaged business, woman-owned small business, HubZone, service disabled veteran owned small business, etc.) are specifically identified in the Small Business Participation Plan;
- The extent of participation of such firms in terms of the value of the total acquisition in %'s for the base year and for each individual option year; the extent of commitment to use such firms (for example, enforceable commitments, i.e., teaming agreements signed, are to be considered more heavily than non-enforceable ones);
- The complexity and variety of the work small firms are to perform on this acquisition;
- The practicality of the Small Business Participation Plan, i.e., aggressive goals.

The Small Business Participation Plan shall be organized as follows:

(1) Prime Contractor type of business (check all that apply):
( ) Large
( ) Small (also check type of small business)
( ) Small Non-Disadvantaged Business

( ) Small Disadvantaged Business
( ) Woman-Owned Small Business
( ) HUBZone Small Business
( ) Veteran Owned Small Business
( ) Service Disabled, Veteran Owned Small Business

(2) Percentage of your participation as a prime contractor: _____ %

NOTE: Small Business primes' self-performance counts as Small Business Participation, and small business primes may achieve small business participation goals through their own performance/participation as a prime and/or through subcontracting to other small businesses.

(3) Percentage of total contract value of subcontracts planned for:

	% of Total Contract Value
Large	%
Total Small	%
Small Non-Disadvantaged	%
Small Disadvantaged	%
Small Woman Owned	%
Small HUB Zone	%
Small Veteran Owned	%
Small Service Disabled Veteran Owned	%

Each percentage above shall be accompanied by detailed supporting documentation regarding individual commitments.

NOTE: The sum of the percentages of Small Non-Disadvantaged and Small Disadvantaged should equal the entries for the Total Small; however, the sum of all of the percentages need not equal 100% since the prime is not included and individual subcontractors may be counted towards more than one category.

(4) List principal supplies/services (be specific) to be subcontracted to:

	Name of Company	Type of Service/Supply
Large		
Small Non-Disadvantaged		
Small Disadvantaged		
Small Woman Owned		
Small HUB Zone		
Small Veteran Owned		
Small Service Disabled Veteran Owned		

(5) Prior Performance Information: Provide any information substantiating the offeror's track record of utilizing small business on past contracts.

(6) For Large ***and*** Small Businesses provide descriptive information for all small business categories. Any information concerning long-term relationships with Small Business subcontractors, such as mentor-protégé relationships, should be provided.

(7) Extent of Commitment: Provide documentation regarding enforceable commitments to utilize any small business category as defined in FAR Part 19 as subcontractors.

(8) Small Business Subcontracting Plan: Each ***Large Business Offeror*** shall provide a Small Business Subcontracting Plan that contains all of the elements required by FAR Clause 52.219-9. This Plan ***shall*** be submitted separately from the Small Business Participation information required above which applies to both Large and Small Businesses. The Subcontracting Plan is not a requirement for evaluation in source selection but rather a requirement for award to a Large Business. The approved Small Business Subcontracting Plan will be incorporated into any resultant contract(s).

7.2 Evaluation Criteria:

ALL OFFERORS ARE REQUIRED TO SUBMIT A SMALL BUSINESS PARTICIPATION PLAN. In accordance with Table 4, Small Business Ratings, the Small Business Participation Plan will be evaluated based on the offeror's best efforts, the level of small business commitment that is being demonstrated for the proposed acquisition, and the prior level of commitment to utilizing small businesses in performance of prior contracts. The Small Business Participation Plan must meet the minimum Total Small Business Participation goal of 20% of the total contract value (through collective small business participation from any type of small business or sub-category small business).

Pursuant to DFARS PGI 215.304(c), the following elements will be considered in evaluating an offeror's Participation Plan:

- The extent to which such firms, as defined in FAR Part 19, are specifically identified in plans;
- The extent of commitment to use such firms (enforceable commitments will be weighted more heavily than non-enforceable ones);
- The complexity and variety of the work such firms are to perform;
- The practicality of the plans;
- Past performance of offerors in complying with the requirements of the Subcontracting Plan Goals for such firms and monetary targets for participation;
- The extent of participation of such firms in terms of the proposed subcontracted value; and
- The extent to which the offeror provides detailed explanations/documentation supporting the proposed participation percentages, or lack thereof. The Department of Defense (DOD) has established small business goals to help ensure small business receives a fair proportion of DOD awards.

8.0 **Volume II - Price and Proforma Information**

8.1 **Tab A - Standard Form 1442 and Proposal Price Breakout Schedule**.

8.1.1 Submission Requirements:

The offeror shall complete and submit Standard Form 1442 and Section 00 10 00, Proposal Price Breakout Schedule. Both of these forms are included in Section 00 10 00 of this solicitation.

8.1.2 Evaluation Criteria:

The price will be evaluated on the base proposal plus all options. The price will be evaluated for fairness and reasonableness through the use of a price analysis. Price will also be checked for unbalancing of line items. Offerors are cautioned to distribute costs appropriately.

8.2 **Tab B – Joint Venture Agreements**

8.2.1 Submission Requirements:

If more than one contractor is listed in Block 14, or the offeror listed in Block 14 is a joint venture (JV), then a signed JV agreement must be submitted with the proposal and the offeror shall be registered in the System for Award Management (SAM) as a legal entity separate from the individual joint venture members. However, each member of the JV must submit its own Unique Entity Identifier (formally DUNS number) with the proposal.

Small business offerors (e.g., 8(a), HUBZone, SDVOSB) submitting a proposal as a JV or Mentor-Protégé shall submit evidence from the offeror's SBA Servicing Agency that the offeror has notified and discussed the proposed joint venture for this specific project with the appropriate SBA Representative or Business Opportunity Specialist. Joint Venture agreements and approved 8(a) Mentor-Protégé agreements must be submitted with the proposal.

8.2.2 Evaluation Criteria:

This information will be used for the purpose of completing the Pre-Award Survey and will not be rated. Joint Venture Agreements and Mentor-Protégé agreements must comply with the relevant regulations in Title 13 of the Code of Federal Regulations in order for an offeror to be eligible for any small business-related price preference. This information will be used for the purpose of completing the Pre-Award Survey and will not be rated.

8.3 **Tab C – Evidence of Ability to Obtain Bonding and Proof of Financial Ability**

8.3.1 Submission Requirements:

A. Financial Capability. Submit Proof of Financial Ability (Most recent financial statement covering assets and liabilities). Include the name, address, and telephone number of offeror's banking institution. If the offeror is a joint venture, submit this information for all joint venture members.
B. Bonding Capability. Submit information showing offeror's ability to be bonded for this project. Include the name, address, and telephone number of the offeror's bonding company.

8.3.2 Evaluation Criteria:

This information will be used for the purpose of completing the Pre-Award Survey and will not be rated. See FAR Part 28 for information related to bonds.

8.4 **Tab D – Pre-Award Information**

8.4.1 Submission Requirements:

A. The offeror shall submit one completed copy of Section 00 45 00, Representations and Certification.

B. The offeror shall submit the following information:

a) Number of years the firm has been in business

b) Name, address, and telephone numbers of two credit/trade references

c) A list of present commitments, including the dollar value

If the offeror is a joint venture, submit this information for all joint venture members.

8.4.2 Evaluation Criteria:

This information will be used for the purpose of completing the Pre-Award Survey and will not be rated.

8.5 Tab E - Subcontracting Plan

8.5.1 Submission Requirements:

Large business offerors shall submit a Subcontracting Plan in accordance with FAR Clauses 52.219-8 and 52.219-9 DEV. To be acceptable, plans must adequately address the required statutory elements and provide sufficient information to enable the Contracting Officer to answer affirmatively questions A through H of Appendix DD, Part 2, AFARS 5119.705. The offeror may use the attached sample sub-contracting plan as a starting point. Percentage goals apply to the total amount being subcontracted.

8.5.2 Evaluation Criteria:
Submitted information will be evaluated for acceptability in accordance with AFARS 5119.705. To be acceptable, subcontracting plans must:

(a) Adequately address the required statutory elements.

(b) Provide sufficient information to enable the Contracting Officer to answer affirmatively questions A through H of Appendix DD (AFARS 5119.705), a copy of which is attached.

(c) To be acceptable, subcontracting plans must meet all of the requirements outlined in Appendix DD, Part 3, AFARS 5119.705. If discussions with offerors are necessary, those areas where the plan is deficient will be reviewed with each offeror with the goal of correcting deficiencies.

NAVFAC/USACE PAST PERFORMANCE QUESTIONNAIRE (Form PPQ-0)

CONTRACT INFORMATION (Contractor to complete Blocks 1-4)

1. Contractor Information
Firm Name: CAGE Code:
Address: DUNs Number:
Phone Number:
Email Address:
Point of Contact: Contact Phone Number:

2. Work Performed as: ☐ Prime Contractor ☐ Sub Contractor ☐ Joint Venture ☐ Other (Explain)
Percent of project work performed:
If subcontractor, who was the prime (Name/Phone #):

3. Contract Information
Contract Number:
Delivery/Task Order Number (if applicable):
Contract Type: ☐ Firm Fixed Price ☐ Cost Reimbursement ☐ Other (Please specify):
Contract Title:
Contract Location:

Award Date (mm/dd/yy):
Contract Completion Date (mm/dd/yy):
Actual Completion Date (mm/dd/yy):
Explain Differences:

Original Contract Price (Award Amount):
Final Contract Price (*to include all modifications, if applicable*):
Explain Differences:

4. Project Description:
Complexity of Work ☐ High ☐ Med ☐ Routine
How is this project relevant to project of submission? (*Please provide details such as similar equipment, requirements, conditions, etc.*)

CLIENT INFORMATION (Client to complete Blocks 5-8)

5. Client Information
Name:
Title:
Phone Number:
Email Address:

6. Describe the client's role in the project:

7. Date Questionnaire was completed (mm/dd/yy)**:**

8. Client's Signature:

NOTE: NAVFAC/USACE REQUESTS THAT THE CLIENT COMPLETES THIS QUESTIONNAIRE AND SUBMITS DIRECTLY BACK TO THE OFFEROR. THE OFFEROR WILL SUBMIT THE COMPLETED QUESTIONNAIRE TO USACE WITH THEIR PROPOSAL, AND MAY DUPLICATE THIS QUESTIONNAIRE FOR FUTURE SUBMISSION ON USACE SOLICITATIONS. THE GOVERNMENT RESERVES THE RIGHT TO VERIFY ANY AND ALL INFORMATION ON THIS FORM.

ADJECTIVE RATINGS AND DEFINITIONS TO BE USED TO BEST REFLECT YOUR EVALUATION OF THE CONTRACTOR'S PERFORMANCE

RATING	DEFINITION	NOTE
(E) Exceptional	Performance meets contractual requirements and exceeds many to the Government/Owner's benefit. The contractual performance of the element or sub-element being assessed was accomplished with few minor problems for which corrective actions taken by the contractor was highly effective.	An Exceptional rating is appropriate when the Contractor successfully performed multiple significant events that were of benefit to the Government/Owner. A singular benefit, however, could be of such magnitude that it alone constitutes an Exceptional rating. Also, there should have been NO significant weaknesses identified.
(VG) Very Good	Performance meets contractual requirements and exceeds some to the Government's/Owner's benefit. The contractual performance of the element or sub-element being assessed was accomplished with some minor problems for which corrective actions taken by the Contractor were effective.	A Very Good rating is appropriate when the Contractor successfully performed a significant event that was a benefit to the Government/Owner. There should have been no significant weaknesses identified.
(S) Satisfactory	Performance meets minimum contractual requirements. The contractual performance of the element or sub-element contains some minor problems for which corrective actions taken by the Contractor appear or were satisfactory.	A Satisfactory rating is appropriate when there were only minor problems, or major problems that the Contractor recovered from without impact to the contract. There should have been NO significant weaknesses identified. Per DOD policy, a fundamental principle of assigning ratings is that Contractors will not be assessed a rating lower than Satisfactory solely for not performing beyond the requirements of the contract.
(M) Marginal	Performance does not meet some contractual requirements. The contractual performance of the element or sub-element being assessed reflects a serious problem for which the Contractor has not yet identified corrective actions. The Contractor's proposed actions appear only marginally effective or were not fully implemented.	A Marginal rating is appropriate when a significant event occurred from which the Contractor had trouble overcoming and that impacted the Government/Owner.
(U) Unsatisfactory	Performance does not meet most contractual requirements and recovery is not likely in a timely manner. The contractual performance of the element or sub-element contains serious problem(s) for which the Contractor's corrective actions appear or were ineffective.	An Unsatisfactory rating is appropriate when multiple significant events occurred from which the contractor had trouble overcoming and that impacted the Government/Owner. A singular problem, however, could be of such serious magnitude that it alone constitutes an Unsatisfactory rating.
(N) Not Applicable	No information or did not apply to your contract	Rating will be neither positive nor negative.

TO BE COMPLETED BY CLIENT

PLEASE CIRCLE THE ADJECTIVE RATING THAT BEST REFLECTS YOUR EVALUATION OF THE CONTRACTOR'S PERFORMANCE.

1. QUALITY:						
a) Quality of technical data/report preparation efforts	E	VG	S	M	U	N
b) Ability to meet quality standards specified for technical performance	E	VG	S	M	U	N
c) Timeliness/effectiveness of contract problem resolution without extensive customer guidance	E	VG	S	M	U	N
d) Adequacy/effectiveness of quality control program and adherence to contract quality assurance requirements (without adverse effect on performance)	E	VG	S	M	U	N
2. SCHEDULE/TIMELINESS OF PERFORMANCE:						
a) Compliance with contract delivery/completion schedules including any significant intermediate milestones. *(If liquidated damages were assessed or the schedule was not met, please address below)*	E	VG	S	M	U	N
b) Rate the contractor's use of available resources to accomplish tasks identified in the contract	E	VG	S	M	U	N
3. CUSTOMER SATISFACTION:						
a) To what extent were the end users satisfied with the project?	E	VG	S	M	U	N
b) Contractor was reasonable and cooperative in dealing with your staff (including the ability to successfully resolve disagreements/disputes; responsiveness to administrative reports; efforts to keep lines of communication open)	E	VG	S	M	U	N
c) To what extent was the contractor cooperative, businesslike, and concerned with the interests of the customer?	E	VG	S	M	U	N
d) Overall customer satisfaction	E	VG	S	M	U	N
4. MANAGEMENT/ PERSONNEL/LABOR						
a) Effectiveness of on-site management, including management of subcontractors, suppliers, materials, and/or labor force?	E	VG	S	M	U	N
b) Ability to hire, apply, and retain a qualified workforce to this effort	E	VG	S	M	U	N
c) Government Property Control	E	VG	S	M	U	N
d) Knowledge/expertise demonstrated by contractor personnel	E	VG	S	M	U	N
e) Utilization of Small Business concerns	E	VG	S	M	U	N
f) Ability to simultaneously manage multiple projects with multiple disciplines	E	VG	S	M	U	N
g) Ability to assimilate and incorporate changes in requirements and/or priority, including planning, execution, and response to Government changes	E	VG	S	M	U	N
h) Effectiveness of overall management (including ability to effectively lead, manage, and control the program)	E	VG	S	M	U	N
5. COST/FINANCIAL MANAGEMENT						
a) Ability to meet the terms and conditions within the contractually agreed price(s)?	E	VG	S	M	U	N
b) Contractor proposed innovative alternative methods/processes that reduced cost, improved maintainability, or other factors that benefited the client	E	VG	S	M	U	N
c) If this is/was a Government cost type contract, please rate the Contractor's timeliness and accuracy in submitting monthly invoices with appropriate back-	E	VG	S	M	U	N

up documentation, monthly status reports/budget variance reports, compliance with established budgets, and avoidance of significant and/or unexplained variances (under runs or overruns)						
d) Is the Contractor's accounting system adequate for management and tracking of costs? *If no, please explain in Remarks section.*	Yes			No		
e) If a Government contract, has it been partially or completely terminated for default or convenience or are there any pending terminations? *Indicate if show cause or cure notices were issued, or any default action in comment section below.*	Yes			No		
f) Have there been any indications that the contractor has had any financial problems? *If yes, please explain below.*	Yes			No		
6. SAFETY/SECURITY						
a) To what extent was the contractor able to maintain an environment of safety, adhere to its approved safety plan, and respond to safety issues? (Includes: following the users rules, regulations, and requirements regarding housekeeping, safety, correction of noted deficiencies, etc.)	E	VG	S	M	U	N
b) Contractor complied with all security requirements for the project and personnel security requirements.	E	VG	S	M	U	N
7. GENERAL						
a) Ability to successfully respond to emergency and/or surge situations (including notifying the COR, PM, or Contracting Officer in a timely manner regarding urgent contractual issues).	E	VG	S	M	U	N
b) Compliance with contractual terms/provisions *(explain if specific issues)*	E	VG	S	M	U	N
c) Would you hire or work with this firm again? *(If no, please explain below)*	Yes			No		
d) In summary, provide an overall rating for the work performed by this Contractor.	E	VG	S	M	U	N

Please provide responses to the questions above (*if applicable*) and/or additional remarks. Furthermore, please provide a brief narrative addressing specific strengths, weaknesses, deficiencies, or other comments that may assist our office in evaluating performance risk *(please attach additional pages if necessary)***:**

AFARS -- Appendix DD Subcontracting Plan Evaluation Guide

Part 1 - Introduction

DD-100 Purpose.

The guide provides a methodology for uniform and consistent evaluation of subcontracting plans within the Army. It is designed to facilitate compliance with the mandates of 15 U.S.C. § 637(d) to increase opportunities for small and small disadvantaged businesses.

DD-101 Applicability.

In accordance with requirements of FAR 19.705-4, DFARS 219.705-4 and AFARS 5119.705-4, the contracting officer shall use this guide to review all subcontracting plans (except those for commercial items), including those submitted in response to the provisions in FAR 19.705-2(d) and (e). When the contract will require subcontracting plans, use the clauses designated by FAR 19.708(b)(1) and (2) and DFARS 219.708(b)(1)(A) in the solicitation. A copy of the completed evaluation shall be included in the contract file.

DD-102 Goals.

Contracting officers must place special emphasis on negotiating subcontracting goals that are realistic, challenging and attainable. The plan must express goals in terms of percentages of total planned subcontracting dollars and must be comparable to the dollar commitments in the small business participation plan. In accordance with FAR 19.705-4(d), the contracting officer must review enough evidence to determine that the:

1.Offeror can meet subcontracting plan goals;

2.Offeror's goals are consistent with their cost or pricing data or information other than cost or pricing data;

3. Offeror will honor the terms of subcontract agreements (i.e., timely payments of amounts owed, use of firms cited in proposal, etc.); and

4.Offeror's make or buy policy or program does not conflict with the proposed subcontracting plan and is in the Government's best interest.

5. Plan includes the contractor's commitment to adopt and comply with its requirements and goals for small business utilization.

DD-103 Evaluation Rating.

Either the contracting officer, the small business representative, or both, shall evaluate and rate the subcontracting plan as "acceptable" or "unacceptable," in the context of the particular procurement. For instance, in smaller dollar value contracts, or contracts for uniquely manufactured items, it might be impracticable or not cost effective for offerors to take the type of actions that might be appropriate in contracts for larger dollar values or commercial components. To receive an "Acceptable" rating, the contractor must satisfy all objectives in Part 2 and meet each statutory subcontracting plan requirement outlined in Part 3. Failure to receive a subcontracting plan rating of acceptable could jeopardize the offeror's selection for contract award. The contracting officer must document the decisions in the contract file.

DD-104 Modification of Guide.

Pursuant to AFARS 5101.403, only senior contracting officials may approve individual deviations to this evaluation guide. This approval authority may not be further delegated.

DD-105 Use of Preaward Surveys.

For contracts administered by the Defense Contract Management Agency, obtain information needed to assess contractor compliance with subcontracting plans in current and previous contracts by requesting a preaward survey in accordance with FAR 9.106, DFARS 209.106 and DFARS PGI 209.106.

Part 2 - Rating System

DD-201 Acceptable Plans.

Objective: The subcontracting plan meets all of the requirements outlined in Part 3. The offeror has provided details that demonstrate an acceptable approach to assisting, promoting and utilizing small businesses, small disadvantaged businesses, women-owned small businesses, historically underutilized business zone small businesses, veteran-owned small businesses, service disabled veteran-owned small businesses and, for Defense Research Programs, historically black colleges and universities and minority serving institutions. The offeror has demonstrated an ability to meet prior subcontracting plan goals and honor the terms of subcontract agreements. Offeror has outlined an approach utilizing mentor protégé firms, joint venture teams, or other partners. The subcontracting goals are realistic, challenging, and attainable. Clarifications and minor rework of the submission may be required to correct slight omissions that do not prejudice other offers.

DD-202 Unacceptable Plans.

Objective: The subcontracting plan fails to meet a requirement outlined in Part 3. The offeror has not provided an acceptable approach to assisting, promoting, and utilizing small businesses. The offeror has a history of failing to honor subcontract agreements. The offeror did not discuss the establishment of mentor protégé relationships, teaming, or joint venture agreements with other firms. Ensure the proposed subcontracting goals are attainable in light of the contractor's past performance in meeting subcontracting goals. Proposed subcontracting goals reflect less than a good faith effort. Substantial rework of the document is required to correct omissions and establish realistic, challenging, and attainable goals. Failure to receive a rating of acceptable may jeopardize offeror's eligibility for contract award. See FAR 19.702(a)(1).

Part 3 - Subcontracting Plan Requirements

DD-301 Requirements.

If any of the following are answered "NO", the plan is not acceptable, and the offeror must revise it before contract award. Does the plan:

1. Contain a policy statement or evidence of internal guidance to company buyers that commits to complying with the Small Business Act (Public Law 99-661, Section 1207 and Public Law 100-180)?

2. Identify separate percentage goals for utilizing small businesses (including Alaska Native Corporations (ANCs) and Indian tribes), veteran-owned small businesses (VOSB), service-disabled veteran-owned small businesses (SDVOSB), historically underutilized business zone small businesses (HUBZone), small disadvantaged businesses (SDB), women-owned small businesses (WOSB), and, for Defense Research Programs, historically black colleges and universities and minority serving institutions where applicable? Negotiated subcontracting goals must correlate with percentages of small business utilization identified in the contractor's small business participation plan, see FAR 15.304 and DFARS 215-304, and/or minimum targets identified in the solicitation or contract modification. FAR 19.704(a)(1)

3. Project the total dollars planned to be subcontracted and a separate statement of the total dollars planned to be subcontracted to small business (including ANCs and Indian tribes), VOSB, SDVOSB, HUBZone, SDB, and WOSB concerns? FAR 19.704(a)(2)

4. Describe the principal types of supplies and services to be subcontracted and identify the types planned for subcontracting to small business (including ANCs and Indian tribes), VOSB, SDVOSB, HUBZone, SDB and WOSB concerns?

5. Describe the method to be used to develop the subcontracting goals? FAR 19.704(a)(4)

6. Describe the method for identifying potential sources for solicitation purposes? FAR 19.704(a)(5)

7. State if the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with small business, VOSB, SDVOSB, HUBZone, SDB (including ANCs and Indian tribes), and WOSB concerns? FAR 19.704(a)(6)

8. Identify the name of the employee who will administer the offeror's subcontracting program and describe that person's duties? FAR 19.704(a)(7)

9. Provide an approach for ensuring that small businesses, VOSB, SDVOSB, HUBZone, SDB, (including ANCs and Indian tribes) and WOSB concerns will have an equitable opportunity to compete for subcontracts?

10. Require the offeror to include the clause at FAR 52.219-8, Utilization of Small Business Concerns in all subcontracts that offer further subcontracting opportunities and require all subcontractors (except small business concerns) that receive subcontracts over $650,000 ($1,500,000 for construction) to adopt a plan that complies with the requirements of the clause at FAR 52.219-9, Small Business Subcontracting Plan?

11. Provide assurances that the offeror will:

a. Cooperate in required studies or surveys;

b. Submit periodic reports so that the Government can determine the extent of offeror's compliance with the subcontracting plan;

c. Submit semi-annual Individual Subcontract Reports (ISRs) and/or Summary Subcontract Reports (SSR) in the Electronic Subcontracting Reporting System (eSRS) (http://www.esrs.gov) in accordance with FAR 52.219-9 or provide other ancillary reports as requested by the contracting officer or Army Small Business Office;

d. Ensure that its subcontractors with subcontracting plans agree to submit the ISRs and/or SSRs using the eSRS;

e. Provide its prime contract number and its DUNS number and the e-mail address of the Government or contractor employee responsible for acknowledging or rejecting the reports, to all first-tier subcontractors with subcontracting plans so they can enter this information into the eSRS when submitting their reports; and

f. Require each subcontractor with a subcontracting plan to provide the prime contract number and its own DUNS number, and the e-mail address of the Government or contractor official responsible for acknowledging or rejecting the reports, to its subcontractors with subcontracting plans? FAR 19.704(10)

12. Describe the types of records that the contractor will maintain concerning procedures adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to

locate small business, VOSB, SDVOSB, HUBZone, SDB, and WOSB concerns and to award subcontracts to them? FAR 19.704(11)

13.Does plan, pursuant to FAR 19.704(11)(c), provide a separate goal for the basic contract and, if applicable, each option?

SMALL BUSINESS SUBCONTRACTING PLAN (SAMPLE)

Revised December 2020

Federal Acquisition Regulation (FAR), paragraph 19.708(b)(1)) prescribes the use of the clause at FAR 52.219-9 Alt II entitled "Small Business Subcontracting Plan." The following is a suggested model for use when formulating such subcontracting plan. While this model plan has been designed to be consistent with FAR 52.219-9 Alt II, other formats of a subcontracting plan may be acceptable. However, failure to include the essential information as exemplified in this model may be cause for either a delay in acceptance or the rejection of a bid or offer where the clause is applicable. Further, the use of this model is not intended to waive other requirements that may be applicable under FAR 52.219-9 Alt II. "SUBCONTRACT," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a federal government prime contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

I. IDENTIFICATION DATA:

Company Name: _____

Address: _____

Date Prepared: _____ Solicitation Number: _____

Description: _____

Contract Dollar Value: _____

II. TYPE OF PLAN (circle one)

A. Individual Plan (All elements developed specifically for this contract and applicable for the full term of this contract, including any option periods.)

B. Master Plan (Goals developed for this contract; all other elements standard; must be renewed every three years)

C. Commercial Plan Commercial products/service plan, including goals, covers the offeror's fiscal year and applies to the entire production of commercial items or delivery of services sold by either the entire company or a portion thereof (e.g., division, plant, or product line); this includes planned subcontracting for both commercial and Government business. In accordance with FAR 19.704(d), "A commercial plan (as defined in FAR 19.701) is the preferred type of subcontracting plan for contractors furnishing commercial items."(Contractor sells large quantities of off-the-shelf commodities to many Government agencies. Plans/goals negotiated by a lead agency on a company-wide basis rather than for individual contracts. Plan effective only during the year for which it is approved. The contractor must provide a copy of the lead agency approval.)

III. GOALS:

(For information purposes only: FAR 19.704(a)(1) requires separate percentage goals for using Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns as subcontractors; and a statement of the total dollars planned to be subcontracted to Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns. NOTE: The dollar amounts planned for subcontracting must be expressed as percentages of total subcontracting dollars as shown below.)

State separate dollar and percentage goals, expressed in terms of percentages of total subcontracting dollars, for the use of Large Business, Small Business, Veteran-Owned Small Business, Service Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, Woman-Owned Small Business, and Historically Black Colleges and Universities/Minority Institutions concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs in the following format. (For a contract with options, provide a separate statement for the basic contract and individual statements for each option year.)

A. **BASE BID ONLY:** The following percentage goals (expressed in terms of a percentage of total planned subcontracting dollars) and dollar amounts are applicable to the contract cited above or to the contract awarded under the solicitation cited. Total Base Bid is $_____.

(i) Total estimated dollar value of all planned subcontracting for an individual contract plan; or the offerors total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan; i.e., the sum of a and b above: $ (100 Percent) $_____ and _____ %

(ii) Total estimated dollar value and percent of planned subcontracting with Small Business (including Veteran-Owned Small Business, Service Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, Woman-Owned Small Business, and Historically Black Colleges and Universities/Minority Institutions concerns): (% of "(i)") $_____ and _____%

(iii) Total estimated dollar value and percent of planned subcontracting with large businesses (all business concerns classified as "other than small"): (% of "(i)") $_____ and _____ %

(iv) Total estimated dollar value and percent of planned subcontracting with Small Disadvantaged Business concerns (SDB): $_____ and _____ % of total planned subcontracting dollars under this contract will be awarded to subcontractors who are small concerns owned and controlled by socially and economically disadvantaged individuals and appear on the Small Business Administration's list. (% of "(i)")

(v) Total estimated dollar value and percent of planned subcontracting with Women-Owned Small Business concerns (WOSB): $_____ and _____ % of total planned subcontracting dollars under this contract will be awarded to subcontractors who are WOSB. (% of "(i)")

(vi) Total estimated dollar value and percent of planned subcontracting with Veteran-Owned Small Business concerns (VOSB): $_____ and _____ % of total planned subcontracting dollars under this contract will be awarded to subcontractors who are VOSB. (% of "(i)")

(vii) Total estimated dollar value and percent of planned subcontracting with Service-Disabled Veteran-Owned Small Business concerns (SDVOSB): $_____ and _____ % of total planned subcontracting dollars under this contract will be awarded to subcontractors who are SDVOSB. (% of "(i)")

(viii) Total estimated dollar value and percent of planned subcontracting with Historically Black Colleges and Universities/Minority Institutions (HBCU/MI): $_____ and _____ % of total planned subcontracting dollars under this contract will go to HBCU's who are an institution determined by the Secretary of Education to meet the requirements of 34 CFR 608.2, the term also includes any nonprofit research institution that was an integral part of such a college or university before November 14, 1986; or MI's who are an institution of higher education meeting the requirements of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)) which, includes a Hispanic-serving institution of higher education as defined in Section 316(b)(1) of the Act (20 U.S.C. 1059c(b)(1)). (% of "(i)")

(ix) Total estimated dollar value and percent of planned subcontracting with HUBZone Small Business concerns: $_____ and _____ % of total planned subcontracting dollars under this contract will go to subcontractors who are small business concerns located in a historically underutilized business zone which is an area located within one or more qualified census tracts, qualified non-metropolitan counties, or lands within the external boundaries of an Indian reservation and appear on the Small Business Administration's HUBZONE web site at www.sba.gov/HUBZONE. (% of "(i)")

The following principal products and/or services will be subcontracted under the Base Bid of this contract, and the distribution among Large Business, Small Business, Veteran-Owned Small Business, Service Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, Woman-Owned Small Business, and Historically Black Colleges and Universities/Minority Institutions is as follows: **(Check all that apply)**

Subcontractor Name	**Product or Service/ Description**	**Large Business**	**Small Business**	**VOSB**	**SDVOSB**	**HSB**	**SDB**	**WOSB**	**HBCU/ MI**

(ATTACHMENT MAY BE USED IF ADDITIONAL SPACE IS REQUIRED)

B. **OPTIONS:** You must include a separate goal for each option. See the attached Continuation Sheet for Paragraph A for each option.

C. The following method was used in developing subcontract goals (i.e., Statement explaining how the product and service areas to be subcontracted were established, how the areas to be subcontracted to Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns were determined, and how Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns' capabilities were determined, to include identification of source lists utilized in making those determinations. Also, a statement as to what efforts will be taken to improve on past goals and how SB and SDB firms will be included in areas without previous SB/SDB involvement).

D. A description of the method used to identify potential **SOURCES** for solicitation purposes (e.g., whether you used existing company source lists, the System for Award Management (SAM)) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, disadvantaged, and women-owned small business trade associations. A firm may rely on the information contained in SAM as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned, service-disabled veteran-owned, HUBZone small, small disadvantaged and women-owned small business source list. Use of SAM as its source list does not relieve a firm of its responsibilities e.g., outreach, assistance, counseling, and publicizing subcontracting opportunities) in this clause.

E. Indirect and overhead costs (check one): ____ HAVE ____ HAVE NOT been included in the goals specified in Paragraph A and Paragraph B.

F. If "HAVE" was selected in Paragraph E, explain the method used in determining the proportionate share of indirect and overhead cost to be allocated as subcontracts to Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns. (NOTE: Commercial Plans Must Include Indirect Costs).

IV. PROGRAM ADMINISTRATOR:

(For information purposes only: FAR 19.704(a)(7) requires information about the company employee who will administer the subcontracting program. Please provide the name, title, address, telephone number, fax machine number, email address, position within the corporate structure, and the duties of that employee.)

Name: _____

Title: _____

Position: _____

Address: _____

_____

Telephone No: _____

Fax No: _____

Email Address: _____

This individual's specific duties, as they relate to the firm's subcontracting program, are as follows:
General overall responsibility for this company's Small Business Program, the development, preparation and execution of individual subcontracting plans and for monitoring performance relative to contractual subcontracting requirements contained in this plan, including but not limited to:

A. Developing and maintaining offerors/bidders lists of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns from all possible sources. Our firm may rely on the information contained in the SBA Small Business Source System, as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business source list. The Small Business Administration's (SBA's) list of Small Disadvantaged Businesses and small HUBZone businesses can be accessed through www.sam.gov. Select "Dynamic Small Business Search" to access the SBA small business source system.

B. Ensuring that procurement packages are structured to permit Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns to participate to the maximum extent possible.

C. Assuring inclusion of Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns in all solicitations for products or services that they are capable of providing.

D. Reviewing solicitations to remove statements, clauses, etc., which may tend to restrict or prohibit Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business participation, including recommendations to set aside competitions for SDB's

E. Ensuring periodic rotation of potential subcontractors on bidders' lists.

F. Ensuring that the bid proposal review board documents its reasons for not selecting low bids submitted by Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns.

G. Ensuring the establishment and maintenance of records of solicitations and subcontract award activity.

H. Attending or arranging for attendance of company counselors at Business Opportunity Workshops, Minority Business Enterprise Seminars, Trade Fairs, etc.

I. Conducting or arranging for conduct of motivational training for purchasing personnel pursuant to the intent of Public Laws 95-507, 99-661, and 100-180.

J. Monitoring attainment of proposed goals.

K. Preparing and submitting timely, required subcontract reports

L. Coordinating contractor's activities during the conduct of compliance reviews by Federal agencies.

M. Coordinating the conduct of contractor's activities involving its Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business subcontracting program.

N. Ensuring Individual Subcontract Reports (ISRs) and Summary Subcontract Reports (SSRs) are submitted using eSRS (http://www.esrs.gov), following the instructions in the eSRS.

O. Notifying the Contracting Officer or his representative in writing of any substitutions of firms that are not Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business for the firms listed in the subcontracting plan.

P. Additions to (or deletions from) the duties specified above are as follows:

_____
_____
_____
_____
_____
_____

V. EQUITABLE OPPORTUNITY:

(For information purposes only: FAR 19-704(8) requires a description of the efforts the contractor will make to ensure that Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns will have an equitable opportunity to compete for subcontracts.)

The following efforts will be taken to assure that Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns will have an equitable opportunity to compete for subcontracts, including items not traditionally awarded to SB or SDB firms:

A. Outreach efforts will be made by:

(i) Contacts with minority and small business trade associations such as veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce.

(ii) Contacts with business development organizations.

(iii) Attendance at small and minority business procurement conferences and trade fairs.

(iv) Sources will be requested from Small Business Administration's small business source system.

(v) Reviews to determine the competence, ability, experience and capacity available from SB and SDB firms and providing technical assistance to same.

(vi) Evaluations of our SB, SDB, WOSB, VOSB, SDVOSB and HUBZone award performance and program effectiveness against goals established company wide.

B. The following internal efforts will be made to guide and encourage buyers:

(i) Workshops, seminars and training programs will be conducted.

(ii) Activities will be monitored to evaluate compliance with this subcontracting plan, evaluating SB, SDB, WOSB, VOSB, SDVOSB and HUBZone award performance and program effectiveness.

(iii) Small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concern source lists, guides and other data identifying small, small disadvantaged and women-owned small business concerns will be maintained and utilized by buyers in soliciting subcontracts.

(iv) Additions to (or deletion from) the above listed efforts are as follows:

_____

_____

_____

_____

_____

VI. FLOW DOWN CLAUSE:

(For information purposes only: FAR 19-704(a)(9) requires that your company include FAR 52.219-8, "Utilization of Small Business Concerns," in all subcontracts that offer further subcontracting opportunities. Your company must require all subcontractors, except small business concerns, that receive subcontracts in excess of $700,000 ($1,500,000 for construction) to adopt a plan that complies with the requirements of FAR 52.219-9 Alt II, "Small Business Subcontracting Plan.")

The offeror (contractor) agrees that the clause entitled "Utilization of Small Business Concerns" at FAR 52.219-8 will be included in all subcontracts that offer further subcontracting opportunities, and all subcontractors (except small business concerns) who receive subcontracts in excess of $750,000 ($1,500,000 for construction) will be required to adopt a subcontracting plan that complies with FAR 52.219-9 Alt II. Such plans will be reviewed by comparing them with the provisions of Public Law 95-507, and assuring that all minimum requirements of an acceptable subcontracting plan have been satisfied. The acceptability of percentage goals shall be determined on a case-by-case basis depending on the supplies/services involved, the availability of potential Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business subcontractors, and prior experience. Once approved and implemented, plans will be monitored through the submission of periodic reports, and/or, as time and availability of funds permit, periodic visits to subcontractors facilities to review applicable records and subcontracting program progress.

VII. REPORTING AND COOPERATION:

(For information purposes only: FAR 19-704(a)(10) requires your company (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports which show compliance with the subcontracting plan; (iii) submit the Individual Subcontract Report (ISR), and the Summary Subcontract Report (SSR) using the Electronic Subcontracting Reporting System (eSRS);, (iv) ensure that subcontractors with subcontracting plans agree to submit the ISR and/or the SSR using eSRS, (v) provide the prime contract number, DUNS number, and the e-mail address of the offeror's official responsible for acknowledging receipt of or rejecting the ISRs, to all

first-tier subcontractors with subcontracting plans so they can enter this information into the eSRS when submitting their ISRs, and (vi) require that each subcontractor with a subcontracting plan provide the prime contract number, its own DUNS number, and the e-mail address of the subcontractor's official responsible for acknowledging receipt of or rejecting the ISRs, to its subcontractors with subcontracting plans.)
The offeror/contractor agrees to submit such periodic reports and cooperate in any studies or surveys as may be required by the contracting agency or the Small Business Administration in order to determine the extent of compliance by the offeror/contractor with the subcontracting plan and with the clause entitled "Utilization of Small Business Concerns," contained in the contract. The above reports will include submission of its Individual Subcontracting Report (ISR) and Summary Subcontract Report (SSR)

The offeror/contractor further agrees to ensure that its subcontractors agree to submission of ISRs and SSRs.
ISRs and SSRs shall be submitted via the Electronic Subcontracting Reporting System (eSRS) website www.esrs.gov

Reporting Period	Report Due	Due Date
Oct 1 - Mar 31	ISR/SF294	4/30
Apr 1 - Sept 30	ISR/SF294	10/30
Oct 1 – Mar 31	SSR/SF295	4/30 (for contracts with the DOD)
Apr 1 – Sept 30	SSR/SF295	10/30 (for contracts with DOD)
Oct 1 - Sept 30	SSR/SF295	10/30 (for civilian agencies)
Contract Completion	SSR/SF295	30 days after close of contractor's fiscal year (Commercial Plan)

The offeror/contractor agrees to ensure that subcontractors with subcontracting plans agree to submit the ISR and/or the SSR using eSRS and to provide the prime contract number, DUNS number, and the e-mail address of the offeror's official responsible for acknowledging receipt of or rejecting the ISRs, to all first-tier subcontractors with subcontracting plans so they can enter this information into the eSRS when submitting their ISRs.
The offeror/contractor agrees to require each subcontractor with a subcontracting plan provide the prime contract number, its own DUNS number, and the e-mail address of the subcontractor's official responsible for acknowledging receipt of or rejecting the ISRs, to its subcontractors with subcontracting plans.

VIII. RECORDKEEPING:

(For information purpose only: FAR 19-704(a)(11) requires a list of the types of records your company will maintain to demonstrate the procedures adopted to comply with the requirements and goals in the subcontracting plan.)
The offeror/contractor agrees that he will maintain at least the following types of records to document compliance with this subcontracting plan:

A. Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concern source lists, guides and other data identifying SB/SDB concerns.

B. Organizations contacted for Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business sources.

C. On a contract-by-contract basis, records on all subcontract solicitations over $250,000, indicating on each solicitation (i) whether small business concerns were solicited, and if not, why not; (ii) whether Veteran-Owned Small Business concerns were solicited, and if not, why not; (iii) whether Service-Disabled Veteran-Owned Small Business concerns were solicited, and if not, why not; (iv) whether HUBZone Small Business concerns were solicited, and if not, why not; (v) whether Small Disadvantaged business concerns

were solicited, and if not, why not; (vi) whether Women-Owned Small Business concerns were solicited, and if not, why not; and (vii) reasons for the failure of solicited Small Business, Veteran-Owned Small Business, Service-Disabled Veteran-Owned Small Business, HUBZone Small Business, Small Disadvantaged Business, and Women-Owned Small Business concerns to receive the subcontract award.

D. Records to support other outreach efforts: Contacts with veteran service organizations, Minority and Small Business Trade Associations, etc., and attendance at small and minority business procurement conferences and trade fairs.

E. Records to support internal activities to guide and encourage buyers: Workshops, seminars, training programs, etc., monitoring activities to evaluate compliance.

F. On a contract-by-contract basis, records to support subcontract award data to include name and address and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

G. Records to be maintained in addition to the above are as follows:

_____

_____

_____

_____

_____

IX. ASSURANCES

(For information purpose only: FAR 19.704(a)(12-15) requires assurances from your firm)

A. The offeror/contractor will make a good faith effort to acquire articles, equipment, supplies, services, or materials, or obtain the performance of construction work from the small business concerns that the offeror used in preparing the bid or proposal, in the same or greater scope, amount, and quality used in preparing and submitting the bid or proposal. Responding to a request for a quote does not constitute use in preparing a bid or proposal. An offeror used a small business concern in preparing the bid or proposal if--

(i) The offeror identifies the small business concern as a subcontractor in the bid or proposal or associated small business subcontracting plan, to furnish certain supplies or perform a portion of the contract; or

(ii) The offeror used the small business concern's pricing or cost information or technical expertise in preparing the bid or proposal, where there is written evidence of an intent or understanding that the small business concern will be awarded a subcontract for the related work if the offeror is awarded the contract;

B. The offeror/contractor will provide the contracting officer with a written explanation if the contractor fails to acquire articles, equipment, supplies, services or materials or obtain the performance of construction work as described in (a)(12) of this section. This written explanation will be submitted to the contracting officer within 30 days of contract completion; and

C. The offeror/contractor will not prohibit a subcontractor from discussing with the contracting officer any material matter pertaining to payment to or utilization of a subcontractor.

D. The offeror/contractor will pay its small business subcontractors on time and in accordance with the terms and conditions of the subcontract, and notify the contracting officer if the offeror pays a reduced or an untimely payment to a small business subcontractor (see 52.242-5).

X. SIGNATURES REQUIRED:

This subcontracting plan was SUBMITTED by:

Signature: _____ Date: _____

Typed Name and Title: _____

Phone Number: _____

Contracting Officer Approval: _____ Date: _____

Section 00 45 00 - Representations and Certifications

REPS & CERTS

REPRESENTATIONS AND CERTIFICATIONS

COMPANY NAME AND ADDRESS: _____
_____
_____
PHONE NUMBER: _____
EMAIL ADDRESS: _____

BUSINESS SIZE (select one or more as applicable):
Large Business ____ Small Business ____ HUBZone ____ 8(a) ____ Women-Owned Small Business ____
Economically Disadvantaged Women-Owned Small Business ____ Service-Disabled Veteran-Owned ____

CURRENTLY REGISTERED WITH SYSTEM FOR AWARD MANAGEMENT (SAM): YES ____ NO ____
(Note: See FAR 52.204-7)

TAX IDENTIFICATION NUMBER (TIN): _____

UNIQUE ENTITY IDENTIFIER: _____
(Note: See FAR 52.204-7. The Unique Entity Identifier is a 12 character alphanumeric code.)

CAGE CODE: _____
(Note: See FAR 52.204-7)

CLAUSES INCORPORATED BY REFERENCE

52.209-7	Information Regarding Responsibility Matters	OCT 2018
52.236-28	Preparation of Proposals--Construction	OCT 1997
252.203-7005	Representation Relating to Compensation of Former DoD Officials	SEP 2022
252.204-7007	Alternate A, Annual Representations and Certifications	MAY 2021
252.225-7055	Representation Regarding Business Operations with the Maduro Regime	MAY 2022

CLAUSES INCORPORATED BY FULL TEXT

52.204-8 ANNUAL REPRESENTATIONS AND CERTIFICATIONS (DEC 2022)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 238220.

(2) The small business size standard is $19,000,000.

(3) The small business size standard for a concern that submits an offer, other than on a construction or service acquisition, but proposes to furnish an end item that it did not itself manufacture, process, or produce is 500 employees if the acquisition--

(i) Is set aside for small business and has a value above the simplified acquisition threshold;

(ii) Uses the HUBZone price evaluation preference regardless of dollar value, unless the offeror waives the price evaluation preference; or

(iii) Is an 8(a), HUBZone, service-disabled veteran-owned, economically disadvantaged women-owned, or women-owned small business set-aside or sole-source award regardless of dollar value.

(b)(1) If the provision at FAR 52.204-7, System for Award Management, is included in this solicitation, paragraph (e) of this provision applies.

(2) If the provision at FAR 52.204-7, System for Award Management, is not included in this solicitation, and the Offeror has an active registration in the System for Award Management (SAM), the Offeror may choose to use paragraph (e) of this provision instead of completing the corresponding individual representations and certifications in the solicitation. The Offeror shall indicate which option applies by checking one of the following boxes:

___ (i) Paragraph (e) applies.

___ (ii) Paragraph (e) does not apply and the Offeror has completed the individual representations and certifications in the solicitation. (c) (1) The following representations or certifications in SAM are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless—

(A) The acquisition is to be made under the simplified acquisition procedures in Part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

(C) The solicitation is for utility services for which rates are set by law or regulation.

(ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed $150,000.

(iii) 52.203-18, Prohibition on Contracting with Entities that Require Certain Internal Confidentiality Agreements or Statements--Representation. This provision applies to all solicitations.

(iv) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the provision at 52.204-7, System for Award Management.

(v) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that—

(A) Are not set aside for small business concerns;

(B) Exceed the simplified acquisition threshold; and

(C) Are for contracts that will be performed in the United States or its outlying areas.

(vi) 52.204-26, Covered Telecommunications Equipment or Services--Representation. This provision applies to all solicitations.

(vii) 52.209-2, Prohibition on Contracting with Inverted Domestic Corporations--Representation.

(viii) 52.209-5, Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.

(ix) 52.209-11, Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law. This provision applies to all solicitations.

(x) 52.214-14, Place of Performance--Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.

(xi) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.

(xii) 52.219-1, Small Business Program Representations (Basic, Alternates I, and II). This provision applies to solicitations when the contract is for supplies to be delivered or services to be performed in the United States or its outlying areas, or when the contracting officer has applied part 19 in accordance with 19.000(b)(1)(ii).

(A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.

(B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.

(C) The provision with its Alternate II applies to solicitations that will result in a multiple-award contract with more than one NAICS code assigned.

(xiii) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract is for supplies to be delivered or services to be performed in the United States or its outlying areas, or when the contracting officer has applied part 19 in accordance with 19.000(b)(1)(ii).

(xiv) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xv) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xvi) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial products or commercial services.

(xvii) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of USDA-designated items; or include the clause at 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts.

(xviii) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA- designated items.

(xix) 52.223-22, Public Disclosure of Greenhouse Gas Emissions and Reduction Goals--Representation. This provision applies to solicitations that include the clause at 52.204-7.)

(xx) 52.225-2, Buy American Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xxi) 52.225-4, Buy American-Free Trade Agreements-Israeli Trade Act Certificate. (Basic, Alternates II and III.) This provision applies to solicitations containing the clause at 52.225-3.

(A) If the acquisition value is less than $50,000, the basic provision applies.

(B) If the acquisition value is $50,000 or more but is less than $92,319, the provision with its Alternate II applies.

(C) If the acquisition value is $92,319 or more but is less than $100,000, the provision with its Alternate III applies.

(xxii) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xxiii) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan--Certification. This provision applies to all solicitations.

(xxiv) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran—Representation and Certification. This provision applies to all solicitations.

(xxv) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions.

(2) The following representations or certifications are applicable as indicated by the Contracting Officer:

[Contracting Officer check as appropriate.]

(i) 52.204-17, Ownership or Control of Offeror.

(ii) 52.204-20, Predecessor of Offeror.

(iii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

(iv) 52.222-48, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Certification.

(v) 52.222-52 Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Certification.

(vi) 52.223-9, with its Alternate I, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (Alternate I only).

(vii) 52.227-6, Royalty Information.

(A) Basic.

(B) Alternate I.

(viii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

(d)(1) The following representations or certifications in the SAM database are applicable to this solicitation as indicated:

(i) 252.204-7016 , Covered Defense Telecommunications Equipment or Services—Representation. Applies to all solicitations.

(ii) 252.216-7008 , Economic Price Adjustment—Wage Rates or Material Prices Controlled by a Foreign Government. Applies to solicitations for fixed-price supply and service contracts when the contract is to be performed wholly or in part in a foreign country, and a foreign government controls wage rates or material prices and may during contract performance impose a mandatory change in wages or prices of materials.

(iii) 252.225-7042 , Authorization to Perform. Applies to all solicitations when performance will be wholly or in part in a foreign country.

(iv) 252.225-7049 , Prohibition on Acquisition of Certain Foreign Commercial Satellite Services—Representations. Applies to solicitations for the acquisition of commercial satellite services.

(v) 252.225-7050 , Disclosure of Ownership or Control by the Government of a Country that is a State Sponsor of Terrorism. Applies to all solicitations expected to result in contracts of $150,000 or more.

(vi) 252.229-7012 , Tax Exemptions (Italy)—Representation. Applies to solicitations and contracts when contract performance will be in Italy.

(vii) 252.229-7013 , Tax Exemptions (Spain)—Representation. Applies to solicitations and contracts when contract performance will be in Spain.

(ix) 252.247-7022 , Representation of Extent of Transportation by Sea. Applies to all solicitations except those for direct purchase of ocean transportation services or those with an anticipated value at or below the simplified acquisition threshold.

(2) The following representations or certifications in SAM are applicable to this solicitation as indicated by the Contracting Officer: [Contracting Officer check as appropriate.]

___ (i) 252.209-7002 , Disclosure of Ownership or Control by a Foreign Government.

___ (ii) 252.225-7000 , Buy American—Balance of Payments Program Certificate.

___ (iii) 252.225-7020 , Trade Agreements Certificate.

___ Use with Alternate I.

___ (iv) 252.225-7031 , Secondary Arab Boycott of Israel.

___ (v) 252.225-7035 , Buy American—Free Trade Agreements—Balance of Payments Program Certificate.

___ Use with Alternate I.

___ Use with Alternate II.

___ Use with Alternate III.

___Use with Alternate IV.

___ Use with Alternate V.

___ (vi) 252.226-7002 , Representation for Demonstration Project for Contractors Employing Persons with Disabilities.

___ (vii) 252.232-7015 , Performance-Based Payments—Representation.

(e) The Offeror has completed the annual representations and certifications electronically via the SAM website at https://www.acquisition.gov/. After reviewing the SAM database information, the Offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in FAR 52.204-8(c) and paragraph (d) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer, and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [Offeror to insert changes, identifying change by provision number, title, date]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

(End of provision)

52.204-24 REPRESENTATION REGARDING CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT (NOV 2021)

The Offeror shall not complete the representation at paragraph (d)(1) of this provision if the Offeror has represented that it "does not provide covered telecommunications equipment or services as a part of its offered products or

services to the Government in the performance of any contract, subcontract, or other contractual instrument" in paragraph (c)(1) in the provision at 52.204-26, Covered Telecommunications Equipment or Services--Representation, or in paragraph (v)(2)(i) of the provision at 52.212-3, Offeror Representations and Certifications-Commercial Products and Commercial Services. The Offeror shall not complete the representation in paragraph (d)(2) of this provision if the Offeror has represented that it "does not use covered telecommunications equipment or services, or any equipment, system, or service that uses covered telecommunications equipment or services" in paragraph (c)(2) of the provision at 52.204-26, or in paragraph (v)(2)(ii) of the provision at 52.212-3.

(a) Definitions. As used in this provision-

Backhaul, covered telecommunications equipment or services, critical technology, interconnection arrangements, reasonable inquiry, roaming, and substantial or essential component have the meanings provided in the clause 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment.

(b) Prohibition.

(1) Section 889(a)(1)(A) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2019, from procuring or obtaining, or extending or renewing a contract to procure or obtain, any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. Nothing in the prohibition shall be construed to--

(i) Prohibit the head of an executive agency from procuring with an entity to provide a service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or

(ii) Cover telecommunications equipment that cannot route or redirect user data traffic or cannot permit visibility into any user data or packets that such equipment transmits or otherwise handles.

(2) Section 889(a)(1)(B) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2020, from entering into a contract or extending or renewing a contract with an entity that uses any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. This prohibition applies to the use of covered telecommunications equipment or services, regardless of whether that use is in performance of work under a Federal contract. Nothing in the prohibition shall be construed to--

(i) Prohibit the head of an executive agency from procuring with an entity to provide a service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or

(ii) Cover telecommunications equipment that cannot route or redirect user data traffic or cannot permit visibility into any user data or packets that such equipment transmits or otherwise handles.

(c) Procedures. The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (https://www.sam.gov) for entities excluded from receiving federal awards for "covered telecommunications equipment or services."

(d) Representations. The Offeror represents that--

(1) It [___] will, [___] will not provide covered telecommunications equipment or services to the Government in the performance of any contract, subcontract or other contractual instrument resulting from this solicitation. The Offeror shall provide the additional disclosure information required at paragraph (e)(1) of this section if the Offeror responds "will" in paragraph (d)(1) of this section; and

(2) After conducting a reasonable inquiry, for purposes of this representation, the Offeror represents that--

It [___] does, [___] does not use covered telecommunications equipment or services, or use any equipment, system, or service that uses covered telecommunications equipment or services. The Offeror shall provide the additional disclosure information required at paragraph (e)(2) of this section if the Offeror responds "does" in paragraph (d)(2) of this section.

(e) Disclosures.

(1) Disclosure for the representation in paragraph (d)(1) of this provision. If the Offeror has responded "will" in the representation in paragraph (d)(1) of this provision, the Offeror shall provide the following information as part of the offer:

(i) For covered equipment--

(A) The entity that produced the covered telecommunications equipment (include entity name, unique entity identifier, CAGE code, and whether the entity was the original equipment manufacturer (OEM) or a distributor, if known);

(B) A description of all covered telecommunications equipment offered (include brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); and

(C) Explanation of the proposed use of covered telecommunications equipment and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(1) of this provision.

(ii) For covered services--

(A) If the service is related to item maintenance: A description of all covered telecommunications services offered (include on the item being maintained: Brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); or

(B) If not associated with maintenance, the Product Service Code (PSC) of the service being provided; and explanation of the proposed use of covered telecommunications services and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(1) of this provision.

(2) Disclosure for the representation in paragraph (d)(2) of this provision. If the Offeror has responded "does" in the representation in paragraph (d)(2) of this provision, the Offeror shall provide the following information as part of the offer:

(i) For covered equipment--

(A) The entity that produced the covered telecommunications equipment (include entity name, unique entity identifier, CAGE code, and whether the entity was the OEM or a distributor, if known);

(B) A description of all covered telecommunications equipment offered (include brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); and

(C) Explanation of the proposed use of covered telecommunications equipment and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(2) of this provision.

(ii) For covered services--

(A) If the service is related to item maintenance: A description of all covered telecommunications services offered (include on the item being maintained: Brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); or

(B) If not associated with maintenance, the PSC of the service being provided; and explanation of the proposed use of covered telecommunications services and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(2) of this provision.

(End of provision)

52.209-13 VIOLATION OF ARMS CONTROL TREATIES OR AGREEMENTS--CERTIFICATION (NOV 2021)

(a) This provision does not apply to acquisitions at or below the simplified acquisition threshold or to acquisitions of commercial products and commercial services as defined in Federal Acquisition Regulation 2.101.

(b) Certification. [Offeror shall check either (1) or (2).]

____ (1) The Offeror certifies that--

(i) It does not engage and has not engaged in any activity that contributed to or was a significant factor in the President's or Secretary of State's determination that a foreign country is in violation of its obligations undertaken in any arms control, nonproliferation, or disarmament agreement to which the United States is a party, or is not adhering to its arms control, nonproliferation, or disarmament commitments in which the United States is a participating state. The determinations are described in the most recent unclassified annual report provided to Congress pursuant to section 403 of the Arms Control and Disarmament Act (22 U.S.C. 2593a). The report is available at https://www.state.gov/bureaus-offices/under-secretary-for-arms-control-and-international-security-affairs/bureau-of-arms-control-verification-and-compliance/; and

(ii) No entity owned or controlled by the Offeror has engaged in any activity that contributed to or was a significant factor in the President's or Secretary of State's determination that a foreign country is in violation of its obligations undertaken in any arms control, nonproliferation, or disarmament agreement to which the United States is a party, or is not adhering to its arms control, nonproliferation, or disarmament commitments in which the United States is a participating state. The determinations are described in the most recent unclassified annual report provided to Congress pursuant to section 403 of the Arms Control and Disarmament Act (22 U.S.C. 2593a). The report is available at https://www.state.gov/bureaus-offices/under-secretary-for-arms-control-and-international-security-affairs/bureau-of-arms-control-verification-and-compliance/; or

____ (2) The Offeror is providing separate information with its offer in accordance with paragraph (d)(2) of this provision.

(c) Procedures for reviewing the annual unclassified report (see paragraph (b)(1) of this provision). For clarity, references to the report in this section refer to the entirety of the annual unclassified report, including any separate reports that are incorporated by reference into the annual unclassified report.

(1) Check the table of contents of the annual unclassified report and the country section headings of the reports incorporated by reference to identify the foreign countries listed there. Determine whether the Offeror or any person owned or controlled by the Offeror may have engaged in any activity related to one or more of such foreign countries.

(2) If there may have been such activity, review all findings in the report associated with those foreign countries to determine whether or not each such foreign country was determined to be in violation of its obligations undertaken in an arms control, nonproliferation, or disarmament agreement to which the United States is a party, or to be not adhering to its arms control, nonproliferation, or disarmament commitments in which the United States is a participating state. For clarity, in the annual report an explicit certification of non-compliance is equivalent to a

determination of violation. However, the following statements in the annual report are not equivalent to a determination of violation:

(i) An inability to certify compliance.

(ii) An inability to conclude compliance.

(iii) A statement about compliance concerns.

(3) If so, determine whether the Offeror or any person owned or controlled by the Offeror has engaged in any activity that contributed to or is a significant factor in the determination in the report that one or more of these foreign countries is in violation of its obligations undertaken in an arms control, nonproliferation, or disarmament agreement to which the United States is a party, or is not adhering to its arms control, nonproliferation, or disarmament commitments in which the United States is a participating state. Review the narrative for any such findings reflecting a determination of violation or non-adherence related to those foreign countries in the report, including the finding itself, and to the extent necessary, the conduct giving rise to the compliance or adherence concerns, the analysis of compliance or adherence concerns, and efforts to resolve compliance or adherence concerns.

(4) The Offeror may submit any questions with regard to this report by email to NDAA1290Cert@state.gov. To the extent feasible, the Department of State will respond to such email inquiries within 3 business days.

(d) Do not submit an offer unless--

(1) A certification is provided in paragraph (b)(1) of this provision and submitted with the offer; or

(2) In accordance with paragraph (b)(2) of this provision, the Offeror provides with its offer information that the President of the United States has--

(i) Waived application under U.S.C. 2593e(d) or (e); or

(ii) Determined under 22 U.S.C. 2593e(g)(2) that the entity has ceased all activities for which measures were imposed under 22 U.S.C.2593e(b).

(e) Remedies. The certification in paragraph (b)(1) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly submitted a false certification, in addition to other remedies available to the Government, such as suspension or debarment, the Contracting Officer may terminate any contract resulting from the false certification.

(End of provision)

252.204-7016 COVERED DEFENSE TELECOMMUNICATIONS EQUIPMENT OR SERVICES -- REPRESENTATION (DEC 2019)

(a) Definitions. As used in this provision, covered defense telecommunications equipment or services has the meaning provided in the clause 252.204-7018, Prohibition on the Acquisition of Covered Defense Telecommunications Equipment or Services.

(b) Procedures. The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (https://www.sam.gov) for entities excluded from receiving federal awards for “covered defense telecommunications equipment or services”.

(c) Representation. The Offeror represents that it [ ] does, [ ] does not provide covered defense telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument.

(End of provision)

252.204-7017 PROHIBITION ON THE ACQUISITION OF COVERED DEFENSE TELECOMMUNICATIONS EQUIPMENT OR SERVICES--REPRESENTATION (MAY 2021)

The Offeror is not required to complete the representation in this provision if the Offeror has represented in the provision at 252.204-7016, Covered Defense Telecommunications Equipment or Services--Representation, that it "does not provide covered defense telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument."

(a) Definitions. Covered defense telecommunications equipment or services, covered mission, critical technology, and substantial or essential component, as used in this provision, have the meanings given in the 252.204-7018 clause, Prohibition on the Acquisition of Covered Defense Telecommunications Equipment or Services, of this solicitation.

(b) Prohibition. Section 1656 of the National Defense Authorization Act for Fiscal Year 2018 (Pub. L. 115-91) prohibits agencies from procuring or obtaining, or extending or renewing a contract to procure or obtain, any equipment, system, or service to carry out covered missions that uses covered defense telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system.

(c) Procedures. The Offeror shall review the list of excluded parties in the System for Award Management (SAM) at https://www.sam.gov for entities that are excluded when providing any equipment, system, or service to carry out covered missions that uses covered defense telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system, unless a waiver is granted.

(d) Representation. If in its annual representations and certifications in SAM the Offeror has represented in paragraph (c) of the provision at 252.204-7016, Covered Defense Telecommunications Equipment or Services--Representation, that it "does" provide covered defense telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument, then the Offeror shall complete the following additional representation:

The Offeror represents that it [ ] will [ ] will not provide covered defense telecommunications equipment or services as a part of its offered products or services to DoD in the performance of any award resulting from this solicitation.

(e) Disclosures. If the Offeror has represented in paragraph (d) of this provision that it "will provide covered defense telecommunications equipment or services," the Offeror shall provide the following information as part of the offer:

(1) A description of all covered defense telecommunications equipment and services offered (include brand or manufacturer; product, such as model number, original equipment manufacturer (OEM) number, manufacturer part number, or wholesaler number; and item description, as applicable).

(2) An explanation of the proposed use of covered defense telecommunications equipment and services and any factors relevant to determining if such use would be permissible under the prohibition referenced in paragraph (b) of this provision.

(3) For services, the entity providing the covered defense telecommunications services (include entity name, unique entity identifier, and Commercial and Government Entity (CAGE) code, if known).

(4) For equipment, the entity that produced or provided the covered defense telecommunications equipment (include entity name, unique entity identifier, CAGE code, and whether the entity was the OEM or a distributor, if known).

(End of provision)

Section 00 70 00 - Conditions of the Contract

CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	JUN 2020
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	MAY 2014
52.203-6	Restrictions On Subcontractor Sales To The Government	JUN 2020
52.203-7	Anti-Kickback Procedures	JUN 2020
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	MAY 2014
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	MAY 2014
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2020
52.203-13	Contractor Code of Business Ethics and Conduct	NOV 2021
52.203-19	Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements	JAN 2017
52.204-4	Printed or Copied Double-Sided on Postconsumer Fiber Content Paper	MAY 2011
52.204-9	Personal Identity Verification of Contractor Personnel	JAN 2011
52.204-10	Reporting Executive Compensation and First-Tier Subcontract Awards	JUN 2020
52.204-13	System for Award Management Maintenance	OCT 2018
52.204-18	Commercial and Government Entity Code Maintenance	AUG 2020
52.204-19	Incorporation by Reference of Representations and Certifications.	DEC 2014
52.204-23	Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities	NOV 2021
52.204-25	Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment	NOV 2021
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	NOV 2021
52.209-9	Updates of Publicly Available Information Regarding Responsibility Matters	OCT 2018
52.209-10	Prohibition on Contracting With Inverted Domestic Corporations	NOV 2015
52.210-1	Market Research	NOV 2021
52.211-13	Time Extensions	SEP 2000
52.215-2	Audit and Records--Negotiation	JUN 2020
52.216-4	Economic Price Adjustment-Labor and Material	JAN 2017
52.219-4	Notice of Price Evaluation Preference for HUBZone Small Business Concerns	OCT 2022
52.219-8	Utilization of Small Business Concerns	OCT 2022
52.219-9 Alt II	Small Business Subcontracting Plan (OCT 2022) Alternate II	NOV 2016
52.219-16	Liquidated Damages-Subcontracting Plan	SEP 2021
52.222-3	Convict Labor	JUN 2003
52.222-4	Contract Work Hours and Safety Standards - Overtime Compensation	MAY 2018
52.222-6	Construction Wage Rate Requirements	AUG 2018
52.222-7	Withholding of Funds	MAY 2014
52.222-8	Payrolls and Basic Records	JUL 2021
52.222-9	Apprentices and Trainees	JUL 2005

52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	MAY 2014
52.222-12	Contract Termination-Debarment	MAY 2014
52.222-13	Compliance With Construction Wage Rate Requirements and Related Regulations	MAY 2014
52.222-14	Disputes Concerning Labor Standards	FEB 1988
52.222-15	Certification of Eligibility	MAY 2014
52.222-21	Prohibition Of Segregated Facilities	APR 2015
52.222-26	Equal Opportunity	SEP 2016
52.222-27	Affirmative Action Compliance Requirements for Construction	APR 2015
52.222-37	Employment Reports on Veterans	JUN 2020
52.222-40	Notification of Employee Rights Under the National Labor Relations Act	DEC 2010
52.222-50	Combating Trafficking in Persons	NOV 2021
52.222-54	Employment Eligibility Verification	MAY 2022
52.222-55	Minimum Wages for Contractor Workers Under Executive Order 14026	JAN 2022
52.222-62	Paid Sick Leave Under Executive Order 13706	JAN 2022
52.223-2	Affirmative Procurement of Biobased Products Under Service and Construction Contracts	SEP 2013
52.223-5	Pollution Prevention and Right-to-Know Information	MAY 2011
52.223-6	Drug-Free Workplace	MAY 2001
52.223-12	Maintenance, Service, Repair, or Disposal of Refrigeration Equipment and Air Conditioners.	JUN 2016
52.223-17	Affirmative Procurement of EPA-Designated Items in Service and Construction Contracts	AUG 2018
52.223-18	Encouraging Contractor Policies To Ban Text Messaging While Driving	JUN 2020
52.223-20	Aerosols	JUN 2016
52.223-21	Foams	JUN 2016
52.225-13	Restrictions on Certain Foreign Purchases	FEB 2021
52.227-1	Authorization and Consent	JUN 2020
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	JUN 2020
52.227-4	Patent Indemnity-Construction Contracts	DEC 2007
52.228-2	Additional Bond Security	OCT 1997
52.228-5	Insurance - Work On A Government Installation	JAN 1997
52.228-11 (Dev)	Individual Surety--Pledge of Assets (DEVIATION 2020-O0016)	FEB 2021
52.228-12	Prospective Subcontractor Requests for Bonds	DEC 2022
52.228-14	Irrevocable Letter of Credit	NOV 2014
52.228-15 (Dev)	Performance and Payment Bonds-Construction. (Deviation 2020-O0016)	JUN 2020
52.229-3	Federal, State And Local Taxes	FEB 2013
52.232-5	Payments under Fixed-Price Construction Contracts	MAY 2014
52.232-17	Interest	MAY 2014
52.232-23 Alt I	Assignment of Claims (May 2014) - Alternate I	APR 1984
52.232-27	Prompt Payment for Construction Contracts	JAN 2017
52.232-33	Payment by Electronic Funds Transfer--System for Award Management	OCT 2018
52.232-39	Unenforceability of Unauthorized Obligations	JUN 2013
52.232-40	Providing Accelerated Payments to Small Business Subcontractors	NOV 2021
52.233-1	Disputes	MAY 2014

52.233-3	Protest After Award	AUG 1996
52.233-4	Applicable Law for Breach of Contract Claim	OCT 2004
52.236-2	Differing Site Conditions	APR 1984
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-7	Permits and Responsibilities	NOV 1991
52.236-8	Other Contracts	APR 1984
52.236-9	Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984
52.236-13	Accident Prevention	NOV 1991
52.236-14	Availability and Use of Utility Services	APR 1984
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-21	Specifications and Drawings for Construction	FEB 1997
52.236-26	Preconstruction Conference	FEB 1995
52.242-5	Payments to Small Business Subcontractors	JAN 2017
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.243-4	Changes	JUN 2007
52.244-6	Subcontracts for Commercial Products and Commercial Services	DEC 2022
52.246-12	Inspection of Construction	AUG 1996
52.246-21	Warranty of Construction	MAR 1994
52.248-3 Alt I	Value Engineering-Construction (OCT 2020) - Alternate I	APR 1984
52.249-2 Alt I	Termination for Convenience of the Government (Fixed-Price) (Apr 2012) - Alternate I	SEP 1996
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7000	Requirements Relating to Compensation of Former DoD Officials	SEP 2011
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	DEC 2022
252.203-7002	Requirement to Inform Employees of Whistleblower Rights	DEC 2022
252.203-7003	Agency Office of the Inspector General	AUG 2019
252.203-7004	Display of Hotline Posters	AUG 2019
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004	Antiterrorism Awareness Training for Contractors.	FEB 2019
252.204-7015	Notice of Authorized Disclosure of Information for Litigation Support	MAY 2016
252.204-7018	Prohibition on the Acquisition of Covered Defense Telecommunications Equipment or Services	JAN 2021
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Country that is a State Sponsor of Terrorism	MAY 2019
252.219-7003	Small Business Subcontracting Plan (DOD Contracts)	DEC 2019
252.223-7006	Prohibition On Storage, Treatment, and Disposal of Toxic or Hazardous Materials	SEP 2014
252.223-7008	Prohibition of Hexavalent Chromium	JUN 2013
252.225-7012	Preference For Certain Domestic Commodities	APR 2022
252.225-7048	Export-Controlled Items	JUN 2013

252.225-7052	Restriction on the Acquisition of Certain Magnets, Tantalum, and Tungsten.	DEC 2022
252.225-7056	Prohibition Regarding Business Operations with the Maduro Regime	MAY 2022
252.225-7972 (Dev)	Prohibition on the Procurement of Foreign-Made Unmanned Aircraft Systems (DEVIATION 2020-O0015)	MAY 2020
252.227-7025	Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends	MAY 2013
252.227-7033	Rights in Shop Drawings	APR 1966
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	DEC 2018
252.232-7010	Levies on Contract Payments	DEC 2006
252.232-7017	Accelerating Payments to Small Business Subcontractors--Prohibition on Fees and Consideration	DEC 2022
252.236-7000	Modification Proposals-Price Breakdown	DEC 1991
252.236-7001	Contract Drawings, and Specifications	AUG 2000
252.236-7005	Airfield Safety Precautions	DEC 1991
252.236-7013	Requirement for Competition Opportunity for American Steel Producers, Fabricators, and Manufacturers	JUN 2013
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	DEC 2022
252.244-7000	Subcontracts for Commercial Items	DEC 2022

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52.204-21 BASIC SAFEGUARDING OF COVERED CONTRACTOR INFORMATION SYSTEMS (NOV 2021)

(a) Definitions. As used in this clause--

Covered contractor information system means an information system that is owned or operated by a contractor that processes, stores, or transmits Federal contract information.

Federal contract information means information, not intended for public release, that is provided by or generated for the Government under a contract to develop or deliver a product or service to the Government, but not including information provided by the Government to the public (such as on public websites) or simple transactional information, such as necessary to process payments.

Information means any communication or representation of knowledge such as facts, data, or opinions, in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual (Committee on National Security Systems Instruction (CNSSI) 4009).

Information system means a discrete set of information resources organized for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information (44 U.S.C. 3502).

Safeguarding means measures or controls that are prescribed to protect information systems.

(b) Safeguarding requirements and procedures.

(1) The Contractor shall apply the following basic safeguarding requirements and procedures to protect covered contractor information systems. Requirements and procedures for basic safeguarding of covered contractor information systems shall include, at a minimum, the following security controls:

(i) Limit information system access to authorized users, processes acting on behalf of authorized users, or devices

(including other information systems).

(ii) Limit information system access to the types of transactions and functions that authorized users are permitted to execute.

(iii) Verify and control/limit connections to and use of external information systems.

(iv) Control information posted or processed on publicly accessible information systems.

(v) Identify information system users, processes acting on behalf of users, or devices.

(vi) Authenticate (or verify) the identities of those users, processes, or devices, as a prerequisite to allowing access to
organizational information systems.

(vii) Sanitize or destroy information system media containing Federal Contract Information before disposal or release for reuse.

(viii) Limit physical access to organizational information systems, equipment, and the respective operating environments to authorized individuals.

(ix) Escort visitors and monitor visitor activity; maintain audit logs of physical access; and control and manage physical access devices.

(x) Monitor, control, and protect organizational communications (i.e., information transmitted or received by organizational information systems) at the external boundaries and key internal boundaries of the information systems.

(xi) Implement subnetworks for publicly accessible system components that are physically or logically separated from internal networks.

(xii) Identify, report, and correct information and information system flaws in a timely manner.

(xiii) Provide protection from malicious code at appropriate locations within organizational information systems.

(xiv) Update malicious code protection mechanisms when new
releases are available.

(xv) Perform periodic scans of the information system and real-time scans of files from external sources as files are downloaded, opened, or executed.

(2) Other requirements. This clause does not relieve the Contractor of any other specific safeguarding requirements specified by Federal agencies and departments relating to covered contractor information systems generally or other Federal safeguarding requirements for controlled unclassified information (CUI) as established by Executive Order 13556.

(c) Subcontracts. The Contractor shall include the substance of this clause, including this paragraph (c), in subcontracts under this contract (including subcontracts for the acquisition of commercial products or commercial services, other than commercially available off-the-shelf items), in which the subcontractor may have Federal contract information residing in or transiting through its information system.

(End of clause)

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 548 days after receipt of the Notice to Proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of $930 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.217-7 OPTION FOR INCREASED QUANTITY--SEPARATELY PRICED LINE ITEM (MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within 270 days after issuance of the Notice to Proceed. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(End of clause)

52.219-28 POST-AWARD SMALL BUSINESS PROGRAM REREPRESENTATION (OCT 2022)

(a) Definitions. As used in this clause--

Long-term contract means a contract of more than five years in duration, including options. However, the term does not include contracts that exceed five years in duration because the period of performance has been extended for a cumulative period not to exceed six months under the clause at 52.217-8, Option to Extend Services, or other appropriate authority.

Small business concern--

(1) Means a concern, including its affiliates, that is independently owned and operated, not dominant in its field of operation, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (d) of this clause.

(2) Affiliates, as used in this definition, means business concerns, one of whom directly or indirectly controls or has the power to control the others, or a third party or parties control or have the power to control the others. In determining whether affiliation exists, consideration is given to all appropriate factors including common ownership,

common management, and contractual relationships. SBA determines affiliation based on the factors set forth at 13 CFR 121.103.

(b) If the Contractor represented that it was any of the small business concerns identified in 19.000(a)(3) prior to award of this contract, the Contractor shall rerepresent its size and socioeconomic status according to paragraph (f) of this clause or, if applicable, paragraph (h) of this clause, upon occurrence of any of the following:

(1) Within 30 days after execution of a novation agreement or within 30 days after modification of the contract to include this clause, if the novation agreement was executed prior to inclusion of this clause in the contract.

(2) Within 30 days after a merger or acquisition that does not require a novation or within 30 days after modification of the contract to include this clause, if the merger or acquisition occurred prior to inclusion of this clause in the contract.

(3) For long-term contracts--

(i) Within 60 to 120 days prior to the end of the fifth year of the contract; and

(ii) Within 60 to 120 days prior to the date specified in the contract for exercising any option thereafter.

(c) If the Contractor represented that it was any of the small business concerns identified in 19.000(a)(3) prior to award of this contract, the Contractor shall rerepresent its size and socioeconomic status according to paragraph (f) of this clause or, if applicable, paragraph (h) of this clause, when the Contracting Officer explicitly requires it for an order issued under a multiple-award contract.

(d) The Contractor shall rerepresent its size status in accordance with the size standard in effect at the time of this rerepresentation that corresponds to the North American Industry Classification System (NAICS) code(s) assigned to this contract. The small business size standard corresponding to this NAICS code(s) can be found at https://www.sba.gov/document/support--table-size-standards.

(e) The small business size standard for a Contractor providing an end item that it does not manufacture, process, or produce itself, for a contract other than a construction or service contract, is 500 employees if the acquisition--

(1) Was set aside for small business and has a value above the simplified acquisition threshold;

(2) Used the HUBZone price evaluation preference regardless of dollar value, unless the Contractor waived the price evaluation preference; or

(3) Was an 8(a), HUBZone, service-disabled veteran-owned, economically disadvantaged women-owned, or women-owned small business set-aside or sole-source award regardless of dollar value.

(f) Except as provided in paragraph (h) of this clause, the Contractor shall make the representation(s) required by paragraph (b) and (c) of this clause by validating or updating all its representations in the Representations and Certifications section of the System for Award Management (SAM) and its other data in SAM, as necessary, to ensure that they reflect the Contractor's current status. The Contractor shall notify the contracting office in writing within the timeframes specified in paragraph (b) of this clause, or with its offer for an order (see paragraph (c) of this clause), that the data have been validated or updated, and provide the date of the validation or update.

(g) If the Contractor represented that it was other than a small business concern prior to award of this contract, the Contractor may, but is not required to, take the actions required by paragraphs (f) or (h) of this clause.

(h) If the Contractor does not have representations and certifications in SAM, or does not have a representation in SAM for the NAICS code applicable to this contract, the Contractor is required to complete the following rerepresentation and submit it to the contracting office, along with the contract number and the date on which the rerepresentation was completed:

(1) The Contractor represents that it [ ] is, [ ] is not a small business concern under NAICS Code assigned to contract number .

(2) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it [ ] is, [ ] is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it [ ] is, [ ] is not a women-owned small business concern.

(4) Women-owned small business (WOSB) joint venture eligible under the WOSB Program. The Contractor represents that it [ ] is, [ ] is not a joint venture that complies with the requirements of 13 CFR 127.506(a) through (c). [The Contractor shall enter the name and unique entity identifier of each party to the joint venture: .]

(5) Economically disadvantaged women-owned small business (EDWOSB) joint venture. The Contractor represents that it [ ] is, [ ] is not a joint venture that complies with the requirements of 13 CFR 127.506(a) through (c). [The Contractor shall enter the name and unique entity identifier of each party to the joint venture: .]

(6) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that it [ ] is, [ ] is not a veteran-owned small business concern.

(7) [Complete only if the Contractor represented itself as a veteran-owned small business concern in paragraph (h)(6) of this clause.] The Contractor represents that it [ ] is, [ ] is not a service-disabled veteran-owned small business concern.

(8) [Complete only if the Contractor represented itself as a small business concern in paragraph (h)(1) of this clause.] The Contractor represents that--

(i) It [ ] is, [ ] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material changes in ownership and control, principal office, or HUBZone employee percentage have occurred since it was certified in accordance with 13 CFR part 126; and

(ii) It [ ] is, [ ] is not a HUBZone joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (h)(8)(i) of this clause is accurate for each HUBZone small business concern participating in the HUBZone joint venture. [The Contractor shall enter the names of each of the HUBZone small business concerns participating in the HUBZone joint venture: .] Each HUBZone small business concern participating in the HUBZone joint venture shall submit a separate signed copy of the HUBZone representation.

[Contractor to sign and date and insert authorized signer's name and title.]

(End of clause)

52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
11.5%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is the State of Ohio, County of Greene, City of Dayton.

(End of provision)

52.222-35 EQUAL OPPORTUNITY FOR VETERANS (JUN 2020)

(a) Definitions. As used in this clause--

"Active duty wartime or campaign badge veteran," "Armed Forces service medal veteran," "disabled veteran," "protected veteran," "qualified disabled veteran," and "recently separated veteran" have the meanings given at Federal Acquisition Regulation (FAR) 22.1301.

(b) Equal opportunity clause. The Contractor shall abide by the requirements of the equal opportunity clause at 41 CFR 60-300.5(a), as of March 24, 2014. This clause prohibits discrimination against qualified protected veterans, and requires affirmative action by the Contractor to employ and advance in employment qualified protected veterans.

(c) Subcontracts. The Contractor shall insert the terms of this clause in subcontracts valued at or above the threshold specified in FAR 22.1303(a) on the date of subcontract award, unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Director, Office of Federal Contract Compliance Programs, to enforce the terms, including action for noncompliance. Such necessary changes in language may be made as shall be appropriate to identify properly the parties and their undertakings.

(End of clause)

52.222-36 EQUAL OPPORTUNITY FOR WORKERS WITH DISABILITIES (JUN 2020)

(a) Equal opportunity clause. The Contractor shall abide by the requirements of the equal opportunity clause at 41 CFR 60-741.5(a), as of March 24, 2014. This clause prohibits discrimination against qualified individuals on the basis of disability, and requires affirmative action by the Contractor to employ and advance in employment qualified individuals with disabilities.

(b) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of the threshold specified in Federal Acquisition Regulation (FAR) 22.1408(a) on the date of subcontract award, unless exempted by rules, regulations, or orders of the Secretary, so that such provisions will be binding upon each subcontractor or vendor. The Contractor shall act as specified by the Director, Office of Federal Contract Compliance Programs of the U.S. Department of Labor, to enforce the terms, including action for noncompliance. Such necessary changes in language may be made as shall be appropriate to identify properly the parties and their undertakings.

(End of clause)

52.225-9 BUY AMERICAN—CONSTRUCTION MATERIALS (OCT 2022)

(a) Definitions. As used in this clause--

Commercially available off-the-shelf (COTS) item—

(1) Means any item of supply (including construction material) that is--

(i) A commercial product (as defined in paragraph (1) of the definition of "commercial product" at Federal Acquisition Regulation (FAR) 2.101);

(ii) Sold in substantial quantities in the commercial marketplace; and

(iii) Offered to the Government, under a contract or subcontract at any tier, without modification, in the same form in which it is sold in the commercial marketplace; and

(2) Does not include bulk cargo, as defined in 46 U.S.C. 40102(4) such as agricultural products and petroleum products.

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

Critical component means a component that is mined, produced, or manufactured in the United States and deemed critical to the U.S. supply chain. The list of critical components is at FAR 25.105.

Critical item means a domestic construction material or domestic end product that is deemed critical to U.S. supply chain resiliency. The list of critical items is at FAR 25.105.

Domestic construction material means--

(1) For construction material that does not consist wholly or predominantly of iron or steel or a combination of both-

(i) An unmanufactured construction material mined or produced in the United States; or

(ii) A construction material manufactured in the United States, if--

(A) The cost of its components mined, produced, or manufactured in the United States exceeds 60 percent of the cost of all its components, except that the percentage will be 65 percent for items delivered in calendar years 2024 through 2028 and 75 percent for items delivered starting in calendar year 2029. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic. Components of unknown origin are treated as foreign; or

(B) The construction material is a COTS item; or

(2) For construction material that consists wholly or predominantly of iron or steel or a combination of both, a construction material manufactured in the United States if the cost of foreign iron and steel constitutes less than 5 percent of the cost of all components used in such construction material. The cost of foreign iron and steel includes but is not limited to the cost of foreign iron or steel mill products (such as bar, billet, slab, wire, plate, or sheet), castings, or forgings utilized in the manufacture of the construction material and a good faith estimate of the cost of all foreign iron or steel components excluding COTS fasteners. Iron or steel components of unknown origin are treated as foreign. If the construction material contains multiple components, the cost of all the materials used in such construction material is calculated in accordance with the definition of "cost of components".

Fastener means a hardware device that mechanically joins or affixes two or more objects together. Examples of fasteners are nuts, bolts, pins, rivets, nails, clips, and screws.

Foreign construction material means a construction material other than a domestic construction material.

Foreign iron and steel means iron or steel products not produced in the United States. Produced in the United States means that all manufacturing processes of the iron or steel must take place in the United States, from the initial melting stage through the application of coatings, except metallurgical processes involving refinement of steel additives. The origin of the elements of the iron or steel is not relevant to the determination of whether it is domestic or foreign.

Predominantly of iron or steel or a combination of both means that the cost of the iron and steel content exceeds 50 percent of the total cost of all its components. The cost of iron and steel is the cost of the iron or steel mill products (such as bar, billet, slab, wire, plate, or sheet), castings, or forgings utilized in the manufacture of the product and a good faith estimate of the cost of iron or steel components excluding COTS fasteners.

Steel means an alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements.

United States means the 50 States, the District of Columbia, and outlying areas.

(b) Domestic preference.

(1) This clause implements 41 U.S.C. chapter 83, Buy American, by providing a preference for domestic construction material. In accordance with 41 U.S.C. 1907, the domestic content test of the Buy American statute is waived for construction material that is a COTS item, except that for construction material that consists wholly or predominantly of iron or steel or a combination of both, the domestic content test is applied only to the iron and steel content of the construction materials, excluding COTS fasteners. (See FAR 12.505(a)(2)). The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to information technology that is a commercial product or to the construction materials or components listed by the Government as follows:

___ [Contracting Officer to list applicable excepted materials or indicate “none”]

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that

(i) The cost of domestic construction material would be unreasonable.

(A) For domestic construction material that is not a critical item or does not contain critical components.

(1) The cost of a particular domestic construction material subject to the requirements of the Buy American statute is unreasonable when the cost of such material exceeds the cost of foreign material by more than 20 percent;

(2) For construction material that is not a COTS item and does not consist wholly or predominantly of iron or steel or a combination of both, if the cost of a particular domestic construction material is determined to be unreasonable or there is no domestic offer received, and the low offer is for foreign construction material that is manufactured in the United States and does not exceed 55 percent domestic content, the Contracting Officer will treat the lowest offer of foreign construction material that exceeds 55 percent domestic content as a domestic offer and determine whether the cost of that offer is unreasonable by applying the evaluation factor listed in paragraph (b)(3)(i)(A)(1) of this clause.

(3) The procedures in paragraph (b)(3)(i)(A)(2) of this clause will no longer apply as of January 1, 2030.

(B) For domestic construction material that is a critical item or contains critical components.

(1) The cost of a particular domestic construction material that is a critical item or contains critical components, subject to the requirements of the Buy American statute, is unreasonable when the cost of such material exceeds the cost of foreign material by more than 20 percent plus the additional preference factor identified for the critical item or construction material containing critical components listed at FAR 25.105.

(2) For construction material that does not consist wholly or predominantly of iron or steel or a combination of both, if the cost of a particular domestic construction material is determined to be unreasonable or there is no domestic offer received, and the low offer is for foreign construction material that does not exceed 55 percent domestic content, the Contracting Officer will treat the lowest foreign offer of construction material that is manufactured in the United States and exceeds 55 percent domestic content as a domestic offer, and determine whether the cost of that offer is unreasonable by applying the evaluation factor listed in paragraph (b)(3)(i)(B)(1) of this clause.

(3) The procedures in paragraph (b)(3)(i)(B)(2) of this clause will no longer apply as of January 1, 2030.

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act. (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American statute applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American statute applies, use of foreign construction material is noncompliant with the Buy American statute.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) *\
Item 1:			
Foreign construction material....	..... ___	.... ……. ___	.... ___ .....
Domestic construction material...	..... ___	.... ___	.... ___ .....
Item 2:			
Foreign construction material....	..... ___	.... ……. ___	.... ___ .....
Domestic construction material...	..... ___	.... ___	.... ___ .....

[* Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued)].
[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]
[Include other applicable supporting information.]

(End of clause)

52.225-10 NOTICE OF BUY AMERICAN REQUIREMENT--CONSTRUCTION MATERIALS (MAY 2014)

(a) Definitions. “Commercially available off-the-shelf (COTS) item,” “construction material,” “domestic construction material,” and “foreign construction material,” as used in this provision, are defined in the clause of this solicitation entitled “Buy American --Construction Materials” (Federal Acquisition Regulation (FAR) clause 52.225-9).

(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American statute should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American statute before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American statute, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.229-11 TAX ON CERTAIN FOREIGN PROCUREMENTS--NOTICE AND REPRESENTATION (JUN 2020)

(a) Definitions. As used in this provision--

Foreign person means any person other than a United States person.

Specified Federal procurement payment means any payment made pursuant to a contract with a foreign contracting party that is for goods, manufactured or produced, or services provided in a foreign country that is not a party to an international procurement agreement with the United States. For purposes of the prior sentence, a foreign country does not include an outlying area.

United States person as defined in 26 U.S.C. 7701(a)(30) means--

(1) A citizen or resident of the United States;

(2) A domestic partnership;

(3) A domestic corporation;

(4) Any estate (other than a foreign estate, within the meaning of 26 U.S.C. 701(a)(31)); and

(5) Any trust if--

(i) A court within the United States is able to exercise primary supervision over the administration of the trust; and

(ii) One or more United States persons have the authority to control all substantial decisions of the trust.

(b) Unless exempted, there is a 2 percent tax of the amount of a specified Federal procurement payment on any foreign person receiving such payment. See 26 U.S.C. 5000C and its implementing regulations at 26 CFR 1.5000C-1 through 1.5000C-7.

(c) Exemptions from withholding under this provision are described at 26 CFR 1.5000C-1(d)(5) through (7). The Offeror would claim an exemption from the withholding by using the Department of the Treasury Internal Revenue Service Form W-14, Certificate of Foreign Contracting Party Receiving Federal Procurement Payments, available via the internet at www.irs.gov/w14. Any exemption claimed and self-certified on the IRS Form W-14 is subject to audit by the IRS. Any disputes regarding the imposition and collection of the 26 U.S.C. 5000C tax are adjudicated by the IRS as the 26 U.S.C. 5000C tax is a tax matter, not a contract issue. The IRS Form W-14 is provided to the acquiring agency rather than to the IRS.

(d) For purposes of withholding under 26 U.S.C. 5000C, the Offeror represents that--

(1) It [_]is [_]is not a foreign person; and

(2) If the Offeror indicates ``is'' in paragraph (d)(1) of this provision, then the Offeror represents that--I am claiming on the IRS Form W-14 [__] a full exemption, or [__] partial or no exemption [Offeror shall select one] from the excise tax.

(e) If the Offeror represents it is a foreign person in paragraph (d)(1) of this provision, then--

(1) The clause at FAR 52.229-12, Tax on Certain Foreign Procurements, will be included in any resulting contract; and

(2) The Offeror shall submit with its offer the IRS Form W-14. If the IRS Form W-14 is not submitted with the offer, exemptions will not be applied to any resulting contract and the Government will withhold a full 2 percent of each payment.

(f) If the Offeror selects ``is'' in paragraph (d)(1) and ``partial or no exemption'' in paragraph (d)(2) of this provision, the Offeror will be subject to withholding in accordance with the clause at FAR 52.229-12, Tax on Certain Foreign Procurements, in any resulting contract.

(g) A taxpayer may, for a fee, seek advice from the Internal Revenue Service (IRS) as to the proper tax treatment of a transaction. This is called a private letter ruling. Also, the IRS may publish a revenue ruling, which is an official interpretation by the IRS of the Internal Revenue Code, related statutes, tax treaties, and regulations. A revenue ruling is the conclusion of the IRS on how the law is applied to a specific set of facts. For questions relating to the interpretation of the IRS regulations go to https://www.irs.gov/help/tax-law-questions.

(End of provision)

52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 15% percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of clause)

52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by

_____ Surveys
_____ Auger Borings
_____ Rock Cores
_____ Test Pits
_____ Test Tunnel

Are cores available in Louisville for examination:
_____ Yes
__X__ No

(b) The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being: Wilmington, OH.

(c) Roads and railroads in the general area are shown on the drawings.

(d) Historical data for all areas may be obtained from:
U. S. Department of Commerce
National Climatic Center
Federal Building
Asheville, N. C. 28801
(End of clause)

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

https://www.acquisition.gov/

The full text of a DFARS solicitation provison may be accessed electronically at this/these address(es):

https://www.acq.osd.mil/dpap/dars/dfarspgi/current/index.html

(End of clause)

52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (NOV 2020)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any Defense Federal Acquisition Regulation Supplement (48 CFR Chapter 2) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of clause)

Section 00 73 00 - Supplementary Conditions

WAGE DETERMINATION

"General Decision Number: OH20230081 02/03/2023

Superseded General Decision Number: OH20220081

State: Ohio

Construction Type: Building

County: Greene County in Ohio.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the

Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023
1	01/13/2023
2	02/03/2023

ASBE0008-010 03/01/2022

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 32.33	20.19

BROH0018-003 06/01/2021

	Rates	Fringes
BRICKLAYER	$ 30.87	15.87

BROH0022-010 07/01/2021

	Rates	Fringes
TILE FINISHER	$ 24.98	9.85
TILE SETTER	$ 27.70	14.60

CARP0002-017 05/01/2017

	Rates	Fringes
CARPENTER	$ 25.98	15.98

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* ELEC0082-004 12/05/2022

	Rates	Fringes
ELECTRICIAN	$ 34.25	21.26

ELEV0011-002 01/01/2023

	Rates	Fringes
ELEVATOR MECHANIC	$ 52.72	37.335+a+b

PAID HOLIDAYS:

a. New Year's Day, Memorial Day, Independence Day, Labor Day, Vetern's Day, Thanksgiving Day, the Friday after Thanksgiving, and Christmas Day.

b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years' service.

ENGI0018-034 05/01/2018

Rates Fringes

POWER EQUIPMENT OPERATOR
Crane.....$ 35.89 15.09

ENGI0066-045 06/01/2017

Rates Fringes

POWER EQUIPMENT OPERATOR
Forklift.....$ 28.87 19.66
Grader/Blade.....$ 32.42 19.66
Mechanic.....$ 32.92 19.66

IRON0044-020 06/01/2021

Rates Fringes

IRONWORKER, ORNAMENTAL.....$ 31.32 21.00

IRON0290-006 06/01/2022

Rates Fringes

IRONWORKER (Reinforcing and
Structural).....$ 31.59 23.85

LABO0265-018 05/01/2021

Rates Fringes

LABORER
Mason Tender - Brick.....$ 23.05 17.10

LABO1410-004 05/01/2021

Rates Fringes

LABORER
Common or General;
Asbestos Abatement
(Removal from Ceilings,
Floors, and Walls).....$ 28.15 11.80

PAIN0249-005 06/01/2020

Rates Fringes

PAINTER (Brush and Roller).....$ 24.17 11.22

PAIN0387-002 11/01/2021

Rates Fringes

GLAZIER.....$ 28.18 16.87

PLAS0132-020 06/01/2022

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...$ 29.25 14.69

PLUM0050-009 07/04/2022

Rates Fringes

PIPEFITTER (Excludes HVAC
Pipe Installation).....$ 44.60 28.51

PLUM0162-009 06/01/2022

Rates Fringes

PLUMBER (Includes HVAC Pipe
Installation).....$ 36.47 26.80

ROOF0042-001 08/01/2022

Rates Fringes

ROOFER.....$ 30.90 18.25

SFOH0669-009 04/01/2021

Rates Fringes

SPRINKLER FITTER (Fire
Sprinklers).....$ 39.25 25.81
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* UAVG-OH-0021 01/01/2019

Rates Fringes

OPERATOR: Oiler.....$ 27.56 16.37
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* UAVG-OH-0025 01/01/2018

Rates Fringes

SHEET METAL WORKER, Excludes
HVAC Duct and Unit
Installation.....$ 28.10 23.41
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* UAVG-OH-0027 01/01/2018

Rates Fringes

OPERATOR:
Backhoe/Excavator/Trackhoe.....$ 34.84 14.76

SUOH2012-083 08/29/2014

Rates Fringes

DRYWALL HANGER AND METAL STUD
INSTALLER.....$ 21.02 4.21

FORM WORKER.....$ 22.41 9.01

LABORER: Mason Tender -
Cement/Concrete.....$ 22.95 8.60

LABORER: Pipelayer.....$ 23.98 8.58

OPERATOR: Bobcat/Skid
Steer/Skid Loader.....$ 30.26 12.58

OPERATOR: Bulldozer.....$ 26.01 4.95

OPERATOR: Loader.....$ 29.99 12.80

OPERATOR: Paver (Asphalt,
Aggregate, and Concrete).....$ 30.28 13.29

OPERATOR: Roller.....$ 28.25 12.61

PAINTER: Spray.....$ 22.78 12.40

SHEET METAL WORKER (HVAC Duct
and HVAC Unit Installation
Only).....$ 26.41 17.34

TRUCK DRIVER: Dump (All Types)...$ 22.08 11.51

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any
solicitation was issued) on or after January 1, 2017. If this

contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described

in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

PROJECT TABLE OF CONTENTS

-- End of Project Table of Contents --

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SECTION 00 80 00.00 06

SPECIAL PROVISIONS
04/21

PART 1 GENERAL

Attachments to this specification are as follows:

Project Submittal Register
Attachment A: NASIC Protocols for Contracts Pre-Award
Attachment B: Facility Access Request Form
Attachment C: Three Week Look Ahead Template
Attachment D: Wall Penetration Request Form
Attachment E: Architect Engineer & Construction Services Task Statement
Attachment F: SC Fiber Task Statement

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 2, 2018) Fire Protection Engineering for Facilities

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 51B	(2019) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
ERDC/ITL TR-12-1	(2015) A/E/C Graphics Standard, Release 2.0

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.59	Hazard Communication

1.2 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Mechanical/Electrical Room Layout; G

SD-04 Samples

Equipment Warranty Identification Tags; G

SD-05 Design Data

SF1413 Statement and Acknowledgement

Local Agency Check

Progress Photographs

SD-07 Certificates

Warranty of Construction

NO ASBESTOS - CONTAINING MATERIAL (ACM) CERTIFICATION; G

Construction Phase:

Certification for each individual product installed and identified to contain mineral fibers that no asbestos-containing materials were installed; G

Documentation to show that the products containing mineral fiber materials have been microscopically examined by an AIHA- or NVLAP-certified laboratory and the lab has determined that the material does not contain asbestos; G

Insurance

Sales and Use Tax

SD-11 Closeout Submittals

Preliminary (Working) As-Built Drawings; G

Final As-Built Drawings; G

CAD Working As-Built Drawings; G

Equipment-in-Place List

Maintenance and Parts Data

Warranty Management Plan; G

Completion of BUILDER Update Form; G

1.3 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK

Refer to clause 52.211-12 "LIQUIDATED DAMAGES" in Section 00 70 00 for the amount of Liquidated Damages for the project.

Refer to clause 52.211-10 "Commencement, Prosecution, and Completion of Work" in Section 00 70 00 for a notification of significant contract dates.

1.3.1 Additional Requirements/Clarifications of Work Included Within the Contract

a. The time stated in clause 52.211-10 "Commencement, Prosecution, and Completion of Work" in Section 00 70 00 for completion shall include installation of Government-furnished furniture, if required, as well as as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists.

1.4 NOT USED

1.5 NOT USED

1.6 CONTRACT DRAWINGS AND SPECIFICATIONS

In addition to DFARS 252.236-7001 "Contract Drawings and Specifications" in Section 00 70 00 the following will apply:

a. After Award or no later than Notice to Proceed (NTP), the Government will furnish the Contractor a compact disk containing all technical contract documents in electronic media only. This disk will include a complete set of drawing files and technical specification files which have all amendments included. The disk will contain drawing files in PDF format along with technical specifications in PDF format. These PDF files are the contract documents that represent the construction requirements of the contract, and are being provided for the Contractor's use in printing paper copies of contract documents.

b. In addition, native CAD files(this includes, but not limited to, all source files, models, custom fonts and linestyles, plot files, and images used to create the contract drawings) are provided in accordance with the "AS-BUILT DOCUMENTS" paragraph for the Contractor's use in maintaining and preparing as-built plans. If another CAD Program is used other than the Using Agency's System, all native CAD files that were generated with that software and all support files will also be included. Only native files are to be used for As-Built preparation and information.

c. Native files are to be used for As-Built preparation only. The PDF files are the contract documents that represent the construction requirements of the contract.

1.7 AS-BUILT DOCUMENTS FOR DESIGN BID BUILD PROJECTS

1.7.1 General

This section covers the completion of final as-built drawings, as a requirement of the contract. The Contractor is responsible for maintaining paper copy working as-built drawings during the construction phase. These paper copy drawings will be used by the Contractor to prepare, maintain and submit the final as-built drawings.

1.7.1.1 As-Built Drawings

An as-built drawing is a contract construction drawing revised to reflect the final as-built conditions of the project because of modifications, changes, corrections to the project design required during construction, submittals and extensions of design. The terms "drawings," "contract

drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings that are revised to be used for the "RECORD DRAWING AS-BUILTS".

1.7.1.2 Government-Furnished Files

a. The Contractor will be provided electronic files at the beginning of construction for use during the construction phase which are to be maintained during construction for the preparation of as-builts. The Contractor shall be responsible to print two full size paper copies. The Contractor shall enter changes and corrections on two sets of paper full size construction plans on a weekly basis in accordance with Paragraph "Maintenance of Working As-Built Drawings" in this section.

b. The Contractor is required to prepare final as-built drawings utilizing the native files provided by the Government. If translation is required, the original design models (BIM or CAD) shall be updated to As-Built conditions and then appropriately translated. Updating translated drawings will not be accepted. The contractor shall update the CAD working as-built drawings, in accordance with paragraph "Maintenance of Working As-Built Drawings", on a quarterly basis and submit them to the COR for independent Government review. Both paper and electronic documents shall be available at all times and shall be provided promptly to the Contracting Officer's Representatives when requested. The Contractor shall be responsible for backup of electronic files during construction and for controlling release of information.

1.7.2 Withholding

Maintenance of working as-builts is considered part of the value of the facilities being constructed and will not be paid for as a separate line item. All costs in conjunction with periodic as-built maintenance and final preparation shall be considered a subsidiary obligation of the Contractor.

1.7.2.1 Failure to Maintain

If the Contractor fails to maintain the working as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount up to 10% or which, in the Contracting Officer's judgment, represents the estimated cost of bringing the as-built documents up to date. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of working as-built documents. This includes conversion of submittals and other miscellaneous documents.

1.7.2.2 As-Builts Prepared by Contractor

The Contractor is required to prepare and provide final as-built drawings. The Contractor shall include an activity in the cost-loaded schedule for the final As-Built drawing submittal in the amount defined in the following paragraph. See Section 01 32 01.00 06, PROJECT SCHEDULE, para "Basis for Payment and Cost Loading". This amount shall be withheld and not paid until the final As-Built drawing submittal has been accepted by the Government.

Withholding for the final as-built drawing submittal shall be in the amount of: 1% for contract awards less than $5,000,000; $50,000 for contracts awarded from $5,000,000 to $10,000,000; or $100,000 for contracts awarded greater than $10,000,000. Withholding shall be withheld until the final as-built drawing submittal has been approved and accepted by the Government.

1.7.3 Maintenance of Working As-Built Drawings

The Contractor shall revise two (2) sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These as-built marked drawings shall be kept current on a weekly basis and available on the jobsite at all times. Changes in the work from the contract or additional information which is uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Changes must be reflected on all sheets that the change affects. The working as-built marked drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor before submission of each monthly pay estimate. The working as-built drawings shall show the following information if applicable to the project, but not be limited thereto:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. The correct alignments, grade elevations, typical cross section, earthwork, structures or utilities if any changes were made from contract plans.

d. Additional as-built information that exceeds the detail shown on the Contract Drawings. These as-built conditions include those that reflect structural details, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations and layouts, equipment, sizes, mechanical and electrical room layouts and other extensions of design, that were not shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. It is recognized that the shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the contract drawings. The final as-built construction drawing shall reference the shop drawing file that includes the as-built information. In turn, the shop drawing shall reference the applicable construction as-built drawing. All such shop drawing submittals must include the paper copy and PDF of the drawings.

e. The invert elevations and grades of any drainage structures or ditches installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

h. Where contract drawings present options, only the option selected for construction shall be shown on the final as-built drawings.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarms, fire sprinklers, fire protection, fire detection and irrigation systems and other related systems in this project, shall be incorporated into the as-built drawings to include detailed information for all aspects of the systems including wiring, piping, and equipment drawings.

j. Room numbers shown on the contract drawings are selected for design convenience and may not represent the actual numbers intended for use by the end user. Final as-built drawings shall reflect actual room numbers adopted by the end user.

k. Contract modification (change order price) shall include the Contractor's cost to change working and final as-built drawings to reflect modifications and compliance with the following procedures (See "Markings and Indicators"):

(1) Directions in the modification for posting descriptive changes shall be followed.

(2) A Revision Triangle shall be placed at the location of each deletion.

(3) For new details or sections which are added to a drawing, a Revision Triangle shall be placed by the detail or section title.

(4) For minor changes, a Revision Triangle shall be placed by the area changed on the drawing (each location).

(5) For major changes to a drawing, a Revision Triangle shall be placed by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, a Revision Triangle shall be placed either by the schedule heading or by the change in the schedule.

1.7.4 Preliminary (Working) As-Built Drawings

Six (6) weeks before Contract Completion Date, the Contractor shall submit one (1) set of the original paper working as-built drawings to the Contracting Officer for review and approval. These working as-built marked drawings shall be neat, legible and accurate. The review by Government personnel will be expedited to the maximum extent possible. If upon review, the working as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the working as-built marked drawings to the Contracting Officer within fourteen (14) calendar days. Upon approval, the working as-built drawings will be returned to the Contractor for use in preparation of final as-built drawings.

1.7.5 Preparation of Final As-Built Drawings

The contract drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing

the contract drawings into agreement with approved working as-built drawings, adding such additional drawings as may be necessary.

These final as-built drawings are part of the permanent records of the project and the Contractor shall be responsible for the protection and safety thereof until returned to the Contracting Officer. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

When BIM models are a part of the as-built process, the models shall be provided to the Government as a part of the Final As-Built submittal for a review to verify the correctness of the as-built markups and confirm that all changes have been incorporated into the models. Should errors be determined, the contractor shall update the files and provide a corrected set of files within fourteen (14) calendar days of receipt of comments. An independent Government review, by the Louisville district As-Built Coordinator (CELRL-CDM-Q), will be made on the accepted files to determine compliance to the As-Built requirements and to verify graphics changes were done properly. This review will require the electronic model files, all the files needed to reproduce the contract drawings, a full size set of contract drawings in PDF format and all the shop drawings in PDF format, a scanned set of the paper markups and the paper markups. Upon receipt of any comments from this independent review, the contractor shall update the electronic model files and provide a corrected set of files within fourteen (14) calendar days of receipt of the comments.

In the event the Contractor accomplishes additional work which changes the as-built conditions of the facility, after submission and approval of the working as-built drawings, the Contractor shall be responsible for the addition of these changes to the working as-built drawings and also to the final as-built documents and electronic models.

1.7.6 Markings and Indicators

Changes shall be annotated in accordance with ERDC/ITL TR-12-1 "A/E/C Graphics Standard_Release 2.0" at the following locations:

a. Bottom of the revised detail.
b. Right hand and bottom border aligned with the revised detail.
c. The revision block of the title block.

Separate markings shall be made for each modification negotiated into the contract.

1.7.7 Preparation of Other As-Built Documents

All other non-electronic documents which may include, for example, design analysis, catalog cuts, or certification documents that are not available in native electronic format shall be scanned and provided in an organized manner in Adobe PDF format.

1.7.8 Submittal of Final As-Built Documents

Within fourteen (14) calendar days of Final Acceptance meeting of the project, Final As-Built documents shall be provided to the Contracting Officer in the formats described in paragraph "Electronic File Use". The final as-built document submittal shall also include the approved preliminary paper working as-built drawings.

1.7.9 Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated shall be supplied at the time the facility is occupied or activated. This same as-built information previously furnished must also be shown on the final set of as-built drawings at project completion.

1.7.10 Electronic File Use

Only personnel proficient in the use of the specific BIM software product shall be employed to modify the models or prepare additional new drawings. Additions and corrections to the models shall be equal in quality to that of the originals. Line work, line weights, lettering, layering conventions, and symbols shall be the same as the original line work, line weights, lettering, layering conventions, and symbols. If additional models or drawings are required, they shall be prepared using the specified electronic file format applying the same guidance specified for original drawings. Three dimensional (3D) elements shall be placed in files in their proper locations when using 3D files with spatially correct elements. If the Government provided electronic files in a different format than that requested by the Using Agency, those files will be used for as-built purposes and then translated or exported to format and version required by the Using Agency's. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CAD media files supplied by the Government. All work by the Contractor shall be accomplished on files in the format in which they are provided. The original electronic files provided by the Government will be provided in a format compatible with the Using Agency's. The Using Agency uses Bentley Systems AECOsim Version 8. The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built models. The Contracting Officer will review final as-built models for accuracy and the Contractor shall make all required corrections, changes, additions, and deletions.

a. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm 3/16 inch high. All other contract drawings shall be marked in the bottom right-hand corner of each drawing either "AS-BUILT" drawing denoting no revisions on the sheet, or "REVISED AS-BUILT" denoting one or more revisions. As-Built drawings shall be dated with the Contract Completion Date in the revision block.

b. After receipt by the Contractor of the approved working as-built drawings and the original contract drawings files the Contractor shall, within thirty (30) calendar days, make the final as-built submittal. This submittal shall consist of 2 sets of completed final as-built drawings on separate media consisting of both BIM model files, exported CAD models (both compatible with the Using Agency's system on electronic storage media identical to that supplied by the Government) and full size set in PDF format and the return of the approved marked up working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any translations or adjustments necessary to accomplish this are the responsibility of the

Contractor. The Government reserves the right to reject any files it deems incompatible with the required BIM or CAD software system. All paper drawings, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked drawings as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

1.8 NOT USED

1.9 EQUIPMENT DATA, O&M, & REPAIR MANUALS WITH FIELD TRAINING REQUIREMENTS

1.9.1 Real Property Equipment

Equipment-in-Place Data

Contractor shall be required to make an Equipment-in-Place list of all installed equipment furnished under this contract. This list shall include all information usually listed on manufacturer's name plate. The Form is part of SPECIAL PROVISIONS and is included following the SPECIAL PROVISIONS, so to positively identify the piece of property. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which are specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The information shall also be provided in excel spreadsheet format with columns for above information in addition to floor, space id as listed in the drawings, system, and submittal register id number for the item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies, and in electronic format on CD to the Contracting Officer thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

Maintenance and Parts Data
The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. This information shall be provided electronically in PDF format with bookmarks for each piece of equipment with file name included in a separate column or linked worksheet in the equipment data excel spreadsheet as described in the paragraph above. Distribution of directives shall follow the same requirements as listed in paragraph above.

1.9.2 O&M and Repair Manuals

Withholding & Copies

The Contractor shall provide 6 electronic format copies on CD of the Equipment Operating, Maintenance, and Repair Manuals and two complete hardcopies; these requirements shall apply even through the Technical Specification section indicates otherwise. The manuals shall be prepared electronically in PDF format containing bookmarks for each table of contents item. The PDF file shall be referenced in a separate column or

linked worksheet in the equipment data excel spreadsheet as described previously. Separate manuals shall be provided for each utility system as defined per the Technical Specification. Operations and Maintenance manuals shall be accepted/approved before field training or ninety (90) calendar days before substantial completion (whichever occurs earlier). An amount of $20,000 shall be withheld until submittal and acceptance/approval of O&M manuals is complete. A draft outline and table of contents shall be submitted for acceptance/approval at 50% contract completion. See paragraph "EQUIPMENT DATA, O&M, & REPAIR MANUALS WITH FIELD TRAINING REQUIREMENTS" for detail O&M and Repair Manual format.

1.9.3 Field Training

1.9.3.1 Training Course

Contractor shall conduct a training course for the operating staff for each particular component and system. Where the training period is not identified by the technical specification, a minimum of 1 hour of training shall be provided for that component or system. Training shall only occur after the Manuals have been approved/ accepted by the Government and during normal working time, and shall start after the system or component is functionally completed. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals as identified per individual Technical Specifications. The training will include both classroom and "hands-on" training. The Contractor shall submit a lesson plan outlining the information to be discussed during training periods. This lesson plan will be submitted ninety (90) calendar days before contract completion and accepted/approved before the field training occurs. Training shall be documented by the Contractor and a list of attendees shall be furnished to the Government. Training audio/ video shall be digitally recorded on CDs or DVDs and shall be furnished to the Government within ten (10) calendar days following training.

1.10 AVAILABILITY OF UTILITIES

a. Availability and Use of Utility Services

The Government will furnish electric utilities free of charge for the Contractor's use during construction. The contractor is responsible for maintaining all existing services and ensuring capacity of the service to safely provide the contractor's additional loads.

b. Additional Requirements

(1) Drinking Water may not be obtained from existing outlets by Contractor personnel.

(2) Existing Washing Facilities in the building may not be used by Contractor employees.

1.10.1 Alterations to Utilities

Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) calendar days written notice in advance of the time that the change or relocation is required. In the event that, after the expiration of thirty (30) calendar days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the

Contractor may be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) calendar day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

1.10.2 Interruptions of Utilities

a. No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

b. Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than seventeen (17) working days before date of proposed interruption. The request shall give the following information:

(1) Nature of Utility. (Gas, L.P. or H.P., Water, etc.)
(2) Size of line and location of shutoff.
(3) Buildings and services affected.
(4) Hours and date of shutoff.
(5) Estimated length of time services will be interrupted.

c. Services shall not be shut off until receipt of approval of the proposed hours and date from the Contracting Officer.

d. Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

e. Operation of valves on water mains will be by persons of that utility. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

f. Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

1.11 NOT USED

1.12 PERFORMANCE OF WORK BY THE CONTRACTOR

a. The requirements found in Section 00 70 00, clause 52.236-1 "Performance of Work By the Contractor" apply.

b. For purposes of Section 00 70 00, clause 52.236-1, only, "PERFORMANCE OF WORK BY THE CONTRACTOR" is defined as prime Contractor direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, equipment, or subcontractors. The "TOTAL AMOUNT OF WORK" is defined as total direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, or equipment.

c. Within seven calendar days after the award of any subcontract at any tier, either by himself or a subcontractor, the Contractor shall submit to the Contracting Officer a completed Standard Form SF1413 Statement and Acknowledgement (available at the GSA Forms Library, https://www.gsa.gov/reference/forms#). The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses in Section 00 70 00 of this contract entitled 52.222-4 "Contract Work Hours and Safety Standards - Overtime Compensation"; 52.222-8 "Payrolls and Basic Records"; 52.222-7 "Withholding of Funds"; 52.222-14 "Disputes Concerning Labor Standards"; 52.222-13 "Compliance with Construction Wage Rate Requirements and Related Regulations"; 52.222-6 "Construction Wage Rate Requirements" (formerly named "Davis-Bacon Act"); 52.222-9 "Apprentices and Trainees"; 52.222-10 "Compliance with Copeland Act Requirements"; 52.222-11 "Subcontracts (Labor Standards); 52.222-12 "Contract Termination - Debarment"; 52.222-15 "Certification of Eligibility". Nothing contained in this contract shall create any contractual relation between any subcontractor and the Government.

d. Veterans Employment Emphasis for U.S. Army Corps of Engineers Contracts

In addition to complying with the requirements outlined in Subpart 22.13, provision 52.222-38, clause 52.222-35, clause 52.222-37, DFARS Subpart 222.13 and United States Department of Labor regulations, U.S. Army Corps of Engineers (USACE) contractors and subcontractors at all tiers are encouraged to promote the training and employment of U.S. veterans while performing under a USACE contract. While no set-aside, evaluation preference, or incentive applies to the solicitation or performance under the resultant contract, USACE contractors are encouraged to seek out highly qualified veterans to perform services under this contract. The following resources are available to assist USACE contractors in their outreach efforts:

(1) U.S. Department of Labor Veterans' Employment and Training Service (VETS): https://www.dol.gov/vets/

(2) Federal veteran employment information: https://www.fedshirevets.gov/

(3) Veterans Opportunity to Work (VOW) Program: https://benefits.va.gov/vow/

(4) U.S. Army Warrior Transition Command Employment Index: http://wct.army.mil/modules/employers/index.html

(5) Hiring Our Heroes: https://www.uschamberfoundation.org/hiring-our-heroes

1.13 SUPERINTENDENCE OF SUBCONTRACTORS

a. The Contractor shall be required to furnish the following, in addition to the superintendence required by clause 52.236-6 - "Superintendence By The Contractor" in Section 00 70 00.

(1) If more than 50 percent and less than 70 percent of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70 percent or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

b. If the Contracting Officer, at any time after 50 percent of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirements for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

1.14 IDENTIFICATION OF EMPLOYEES

a. The Contractor shall be responsible for furnishing an identification badge/card to each employee prior to the employees work on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee.

b. The Contractor is required to provide a Local Agency Check for each individual that will be working on this contract.

1.15 NO ASBESTOS - CONTAINING MATERIAL (ACM) CERTIFICATION

1.15.1 Not Used

1.15.2 Construction Phase

Before final payment to the contractor, the contractor's project engineer/manager will sign and submit to the Government, on the contracting firm's letterhead, a dated copy of the following statement:

I hereby certify that to the best of my knowledge noasbestos-containing material (ACM) was used as a building material during this project. Furthermore, I understand that the building owner presumes that all materials marked "May Contain mineral fibers" are considered asbestos unless I either:

a. Submit a certification for each individual product installed and identified to contain mineral fibers that no asbestos-containing materials were installed.

b. Submit documentation to show that the products containing mineral fiber materials have been microscopically examined by an AIHA- or NVLAP-certified laboratory and the lab has determined that the material does not contain asbestos.

1.16 WARRANTY OF CONSTRUCTION

a. In addition to the requirements found in clause 52.246-21 "WARRANTY OF CONSTRUCTION" in Section 00 70 00 the following shall be included:

(1) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(2) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections.

b. Warranty Management

(1) Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause "Warranty of Construction" in clause 52.246-21 in Section 00 70 00. At least thirty (30) calendar days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

(a) Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

(b) Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

(c) A list for each warranted equipment, item, and feature of construction or system indicating:

1. Name of item.

2. Model and serial numbers.

3. Location where installed.

4. Name and phone numbers of manufacturers or suppliers.

5. Names, addresses and telephone numbers of sources of spare parts.

6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.

7. Cross-reference to warranty certificates as applicable.

8. Starting point and duration of warranty period.

9. Summary of maintenance procedures required to continue the warranty in force.

10. Cross-reference to specific pertinent Operation and Maintenance manuals.

11. Organization, names and phone numbers of persons to call for warranty service.

12. Typical response time and repair time expected for various warranted equipment.

(d) The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

(e) Procedure and status of tagging of all equipment covered by extended warranties.

(f) Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

c. Performance Bond

(1) The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

(2) In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(3) In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

(4) Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.16e "Contractor's Response to Warranty Service Requirements". Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed

against the Contractor as outlined in the paragraph 1.16c(2) and/or (3)"Performance Bond" .(2)and/or (3) above.

d. Pre-Warranty Conference

Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

e. Contractor's Response to Warranty Service Requirements.

Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and backcharge the construction warranty payment item established.

(1) First Priority Code 1 Perform on-site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

(2) Second Priority Code 2 Perform on-site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

(3) Third Priority Code 3 All other work to be initiated within (5) five work days and work continuously to completion or relief.

(4) The "Warranty Service Priority List" is as follows:

Code 1 Air Conditioning System
- a. Buildings with computer equipment.
- b. Air Force Reserve Projects, Training Bldg, OMS Administrative Areas of Bldg, and Indoor Ranges.

Code 2 Air Conditioning Systems
- a. Air conditioning leak in part of building, if causing damage.
- b. Air conditioning system not cooling properly

c. Admin buildings with ADP equipment not on priority list.

Code 1 Doors
a. Overhead doors not operational.

Code 1 Electrical
a. Power failure (entire area or any building operational after 1600 hours).
b. Security lights
c. Smoke detectors and fire alarm systems

Code 2 Electrical
a. Power failure (no power to a room or part of building).
b. Receptacle and lights.

Code 3 Electrical
a. Parking area lights

Code 1 Gas
a. Leaks and breaks.

Code 1 Heat
a. Army Reserve Projects, Training Bldg & OMS Administrative Areas of Bldg.
b. Area power failure affecting heat.

Code 2 Heat
a. Army Reserve Projects, Training Bldg & OMS Administrative Areas of Bldg.

Code 3 Interior
a. Floor damage
b. Paint chipping or peeling

Code 1 Intrusion Detection Systems
Finance, PX and Commissary, and high security areas.

Code 2 Intrusion Detection Systems
Systems other than those listed under Code 1.

Code 2 Plumbing
a. Flush valves not operating properly
b. Fixture drain, supply line commode, or water pipe leaking.
c. Commode leaking at base.

Code 3 Plumbing
a. Leaking faucets

Code 1 Refrigeration
a. Mess Hall, Army Reserve Projects.

Code 1 Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2 Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2

basis.

Code 1 Sprinkler System
All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.

Code 1 Water (Exterior)
Normal operation of water pump station.

Code 2 Water (Exterior)
No water to facility.

Code 1 Water, Hot (and Steam)
a. Army Reserve Projects, Training Bldg & OMS Bldg.

Code 2 Water, Hot
No hot water in portion of building listed under Code 1 (items a through c)

(5) Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

f. Equipment Warranty Identification Tags

(1) The Contractor at the time of installation shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how

the Contractor will complete all other tags.

(c) Tags for Warrantied Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

EQUIPMENT WARRANTY CONTRACTOR FURNISHED EQUIPMENT	
MFG NAME	MODEL NO.
SERIAL NO.	
CONTRACT NO.	
CONTRACTOR NAME	
CONTRACTOR WARRANTY EXPIRES	
MFG WARRANTY(IES) EXPIRE	

EQUIPMENT WARRANTY GOVERNMENT FURNISHED EQUIPMENT	
MFG NAME	MODEL NO.
SERIAL NO.	
CONTRACT NO.	
CONTRACTOR NAME	
CONTRACTOR WARRANTY EXPIRES	
MFG WARRANTY(IES) EXPIRE	

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by clause 52.246-21 "WARRANTY OF CONSTRUCTION" in Section 00 70 00.

(2) Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

(3) Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the clause 52.232-5 "Payments Under Fixed-Price Construction Contracts" in Section 00 70 00.

(4) Equipment Warranty Tag Replacement. The Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced

equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

1.17 SALVAGE MATERIALS AND EQUIPMENT

The Contractor shall maintain adequate property control records for all materials or equipment specified in UFGS Section 02 41 00 DEMOLITION AND DECONSTRUCTION to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The Contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care.

1.18 NOT USED

1.19 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the clause 52.249-10 "Default (Fixed-Price Construction)" in Section 00 70 00. In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

Indicate the location of the National Weather Service office closest to the site. See: https://www.weather.gov/srh/nwsoffices The Contractor shall make his own investigations and determinations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being: Wilmington, OH.

The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON FIVE (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
11	8	6	5	6	6	4	3	4	4	5	8

Upon acknowledgment of the Notice to Proceed (NTP) and continuing

throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated listed above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the clause 52.249-10
"Default (Fixed-Price Construction)".

1.20 NOT USED

1.20.1 CONTRACTOR SUPPLY AND USE OF ELECTRONIC SOFTWARE FOR PROCESSING WAGE REQUIREMENT STATUE CERTIFIED LABOR PAYROLLS

a. The contractor is encouraged to use a commercially-available electronic system to process and submit certified payrolls electronically to the Government. The requirements for preparing, processing and providing certified labor payrolls are established by the Wage Rate Requirements statute.

b. If the contractor elects to use an electronic payroll processing system, then the contractor shall be responsible for obtaining and providing for all access, licenses, and other services required to provide for receipt, processing, certifying, electronically transmitting to the Government, and storing weekly payrolls and other data required for the contractor to comply with the Wage Rate Requirements statute. When the contractor uses an electronic payroll system, the electronic payroll service shall be used by the contractor to prepare, process, and maintain the relevant payrolls and basic records during all work under this construction contract and the electronic payroll service shall be capable of preserving these payrolls and related basic records for the required 3 years after contract completion. If the contractor chooses to use an electronic payroll system, then the contractor shall obtain and provide electronic system access to the Government, as required to comply with the Wage Rate Requirements over the duration of this construction contract. The access shall include electronic review access by the Government contract administration office to the electronic payroll processing system used by the contractor.

c. The contractor's provision and use of an electronic payroll processing system shall meet the following basic functional criteria:

(1) commercially available;

(2) compliant with appropriate Wage Rate Requirements statute payroll provisions in the Federal Acquisition Regulation (FAR);

(3) able to accommodate the required numbers of employees and subcontractors planned to be employed under the contract

(4) capable of producing an Excel spreadsheet-compatible electronic output of weekly payroll records for export in an Excel

spreadsheet to be imported into the contractor's Quality Control System (QCS) version of Resident Management System (RMS), that in turn shall export payroll data to the Government's RMS;

(5) demonstrated security of data and data entry rights;

(6) ability to produce contractor-certified electronic versions of weekly payroll data;

(7) ability to identify erroneous entries and track the date/time of all versions of the certified Wage Rate Requirements statute payrolls submitted to the government over the life of the contract;

(8) capable of generating a durable record copy, that is, a CD or DVD and PDF file record of data from the system database at end of the contract closeout. This durable record copy of data from the electronic payroll processing system shall be provided to the Government during contract closeout.

(9) Contractors will upload weekly pay roll records into RMS-Contractor Pay Roll section in the Quality Control System (QCS) version of Resident Management System (RMS), that in turn shall export payroll data to the Government's RM.

d. All contractor-incurred costs related to the contractor's provision and use of an electronic payroll processing service shall be included in the contractor's price for the overall work under the contract. The costs for compliance with the Wage Rate Requirements statute by using electronic payroll processing services shall not be a separately bid or reimbursed item under this contract.

1.21 INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY

a. The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

b. Under no circumstances will steel tracked equipment travel across any pavement, concrete or asphalt, on base. All steel tracked equipment will be transported on trailers to the jobsite.

1.22 AIRSPACE/FAA FORM 7460-1

As described in Title 14 of the Code of Federal Regulations,part 77, when construction within 20,000 feet of an active runway or use equipment in construction which will penetrate a 100 to 1 slope from the nearest point of the runway, among other defined circumstances, notice to the Federal Aviation Administration (FAA) is required for all temporary construction cranes and permanent structures. The Contractor is responsible for ensuring that FAA Form 7460-1 is completed and submitted to the FAA at least 45 calendar days prior to the start of any construction and approved prior to the start of the project by the Regional FAA Office. Form 7460-1 should be submitted as an On-Airport case. The FAA Form 7460-1 can be submitted to electronically at https://oeaaa.faa.gov/oeaaa/external/userMgmt/permissionAction.jsp. Copies of all FAA 7460-1 submittals and determination letters will be

required to be coordinated with and submitted to the Contracting Officer.

1.23 AUTHORIZED WORK DAYS AND HOURS

a. The standard workweek shall be Monday through Friday 0700-1600.

b. Contractor may request days and hours outside of the Standard Work Week when necessary to perform particular task or to maintain or recover schedule. Request are to be made 15 days in advance to the COR and User and not less than that required for schedule Coordination.

c. No work shall occur on federal holidays (New Year's Day, MLK Birthday, Washington's Birthday/President's Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving, and Christmas).

d. Authorized days and hours described above pertain to work inside the existing facilities and/or inside the secure construction laydown areas. Work outside secure areas may be scheduled as needed, subject to advance approval from the Contracting Officer's Representative and confirmation of availability of necessary services.

e. The Contractor shall maintain all contractor facilities and staging areas, maintain the construction access route, and schedule all work and deliveries so as to avoid conflict with the annual Air Force Marathon, scheduled to occur on approximately the third Saturday in September each year. "Days" in this paragraph refers to calendar days.

1. Within 30 days of Notice to Proceed, the Contractor and Government shall jointly inspect the condition of the haul route. The Contractor shall provide photo and/or video documentation of the condition of the pavement during that inspection.

2. Beginning 30 days prior to each scheduled marathon date, the Contractor shall conduct weekly inspections of the haul route to identify any dirt, debris, or damages attributable to construction traffic, and shall correct all deficiencies no later than 7 days prior to the marathon date. Beginning 7 days prior to the marathon date, the Contractor shall conduct daily inspections and correct any remaining deficiencies no later than noon on the Friday preceding the event.

3. Beginning 7 days prior to each scheduled marathon date, the contractor shall ensure all Contractor facilities, staging areas, and construction activities visible from the marathon route present a neat and orderly appearance with no parked equipment or stored materials within 25 feet of the route.

4. No work and no construction traffic of any type shall take place between noon on the Friday preceding each marathon date and six A.M. on the following Monday.

f. Prior to the start of any construction operations, a schedule of work or operations in proper sequence shall be submitted by the contractor for approval by the Fire Protection Branch, Security Police, Safety Office, and the Contracting Officer so as to cause a minimum amount of disruption to the normal flow of traffic on streets, pedestrian travel, base security, and facility operations.

g. Before starting any work where traffic will be impeded or hindered, especially fire trucks and security police vehicles, call and notify the Fire Protection Branch (extension 257-4075) and the Security Forces (257-6516 or 257-6517) 72 hours prior to placing barricades or starting any work. Under no circumstances place any barricades or start work until and have approved the barricading of work areas.

h. Furnish flagmen, barricades, and other warning devices as required to safely route traffic through the construction areas. Selected streets may be closed to traffic when necessary during the construction operations, upon prior approval of the Contracting Officer. When roads are closed, establish and mark safe detours for vehicles to follow. Detours, road closures and lane closures shall be marked and signed in accordance with "Work Zone Traffic Control-Standards and Guidelines" (US Department of Transportation; Federal Highway Administration) or with the Ohio Department of Transportation, Ohio Manual of Uniform Traffic Control Devices (MUTCD). Furnish the Contracting Officer with the names, addresses and telephone numbers of two employees who will be responsible for warning light and barricade maintenance.

i. Gate Hours - (The information in this paragraph is for information only and is subject to change in particular before or after federal holidays and the latter part of December) In general only the 24 hour gates are open on federal holidays and weekends.

1. Normal gate operating hours are:

2. Gate 1A - 24 hours, Broad Street/Spruce Way

3. Gate 12A - 24 hours, Childlaw Road (Main Gate, Area A)

4. Gate 15A - 0600-1800, SR-844/Skeel Avenue

5. Gate 26A(Commercial Vehicle Inspection Gate)- 0600-1800 M-F/0600-1400 Sat, Medway Road

6. Gate hours are subject to change as determined necessary by the Installation Commander.

1.24 NOT USED

1.25 COMPLIANCE WITH POST/BASE REGULATIONS

a. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities.

b. Contractor personnel shall park only in areas authorized by the Contracting Officer.

1.26 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

a. This clause does not apply to terminations. See UAI 5152.249-9000, Basis for Settlement of Proposals, and Federal Acquisition Regulation (FAR) Part 49.

b. Allowable costs for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of Engineer Pamphlet (EP) 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

c. Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

d. When actual equipment costs are proposed and the total amount of the pricing action exceeds the simplified acquisition threshold (SAT), the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate.The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

1.27 NOT USED

1.28 ENGLISH-SPEAKING REPRESENTATIVE

At all times when any performance of the work at any site is being conducted by any employee of the Contractor or his subcontractors, the Contractor shall have a representative present at each site who has the capability of receiving instructions in the English language, fluently speaking the English language and explaining the work operations to persons performing the work, in the language that those performing the work are capable of understanding. The Contracting Officer shall have the right to determine whether the proposed representative has sufficient technical bilingual capabilities, and the Contractor shall immediately replace any individual not acceptable to the Contracting Officer.

1.29 SALES and USE TAX

Some states have tax exemptions for certain aspects of work when done for the federal government and the Contractor shall check with the state where the project is located for more information. If a sales tax exemption is applicable, the contractor is responsible for obtaining any required exemption certification.

1.30 CONTRACTOR SECURITY TRAINING/FACILITY ACCESS REQUIREMENTS

a. All contractor employees, to include subcontractor employees, shall be briefed on the local iWATCH program (training standards provided by the requiring activity ATO) by the contractor and all associated subcontractors. This local developed training will be used to inform employees of the types of behavior to watch for and instruct employees to report suspicious activity to the COR. The training shall be completed within seven (7) calendar days after commencing work on the site with the results reported to the COR NLT seven (7) calendar days after completion of training.

b. All contractor employees, to include subcontractor employees, shall comply with applicable installation, facility and area commander installation/facility access and local security policies and procedures (provided by government representative). The contractor shall also provide all information required for background checks to meet installation access requirements to be accomplished by installation Provost Marshal Office, Director of Emergency Services or Security Office. Contractor workforce must comply with all personal identity verification requirements as directed by DOD, HQDA and/or local policy. In addition to the changes otherwise authorized by clause 52.243-4 - "Changes" in Section 00 70 00 of this contract, should the Force Protection Condition (FPCON) at any individual facility or installation change, the Government may require changes in contractor security matters or processes.

c. Per AR 530-1, Operations Security, all contractor employees and associated subcontractor employees must complete Level 1 OPSEC Training within thirty (30) calendar days of commencing work. Additionally, all contractor employees and associated subcontractor employees must complete annual OPSEC awareness training.

d. Refer to clause 52.222-54: "Employment Eligibility Verification" in Section 00 70 00 for e-Verify requirements.

1.31 INSURANCE--WORK ON A GOVERNMENT INSTALLATION

In addition to the requirements of clause 52.228-5 "Insurance - Work on a Government Installation" found in Section 00 70 00 the following shall be provided:

a. Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than $100,000.00 except in states with exclusive or monopolistic funds.

b. Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than $500,000 per occurrence.

c. Comprehensive Automobile Liability Insurance for both bodily injury and property damage, shall be furnished in limits of not less than $200,000.00 per person, $500,000.00 per accident for bodily injury, and $20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

1.32 AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1)

As covered by clause 52.236-13 "Accident Prevention" in Section 00 70 00, compliance with EM 385-1-1 is a requirement for this contract. Copies may be downloaded from the following website: https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/

1.33 NOT USED

1.34 FIRE PROTECTION DURING CONSTRUCTION

The Contractor is alerted to the requirements of FAR 52.236-12 "Cleaning Up"and more specifically to the requirements for fire protection during construction spelled out in UFC 3-600-01, EM 385-1-1, and NFPA 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under FAR 52.236-13 "Accident Prevention".

1.35 NOT USED

1.36 CONSTRUCTION HAZARD COMMUNICATION

The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard in alignment with the Globally Harmonized System (GHS) (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Classification. Any company which produces or imports a chemical or compound must conduct a hazard classification of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these classifications and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard classification, a substance may be classified as a health hazard or a physical hazard. These classifications are then further broken down into hazard categories according to the severity of the effect:

Health Hazards	**Physical Hazards**
Carcinogens	Combustible liquids
Irritants	Compressed gases
Sensitizers	Explosives
Corrosives	Flammables
Toxic substances	Organic peroxides
Highly toxic substances	Unstable substances

Health Hazards	Physical Hazards
Substances harmful to specific organs or parts of the body	Water-reactive substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a label to every container of that chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the hazard symbol/pictograms, signal words, hazard statements, product name or identifier (identify hazardous ingredients, where appropriate), precautionary statements and pictograms, supplier identification, and supplemental information. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels shall be replaced immediately if they are defaced or removed.

(3) Safety Data Sheets. The producer or importer must also supply a safety data sheet (SDS) that follows the 16 heading format as defined by GHS. The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

(i) Emergency procedures for leaks, spills, fire and first aid.

(ii) Precautions necessary for use, handling, and storage.

(iii) Useful facts about the substance's physical or chemical properties.

(iv) Regulatory information and any other pertinent information including information on preparation and revision of the SDS.

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose.

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling.

Where the SDS's are kept, and an explanation of the labeling system.

Where the Contractor's written Hazard Communication Program is located.

(5) The Written Hazard Communication Program. In accordance with OSHA and the EM 385-1-1 requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included

in the Contractor's Accident Prevention Plan. This document states the hazardous or toxic agent inventory, how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where SDS's will be maintained, and how employees will be provided with specific information and training.

1.37 MECHANICAL/ELECTRICAL ROOM LAYOUT

Detailed mechanical/electrical room layout drawings shall be submitted for approval in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Layout drawings shall show location and maintenance clearances for all mechanical/electrical room equipment, and all utility runs/chases for mechanical, electrical, telephone and other similar systems. Drawings shall be submitted at the same time as the submittals for the equipment to be located within the mechanical/electrical room.

1.38 RED ZONE MEETING

Approximately sixty (60) calendar days prior to Contract Required Completion Date, the Contractor and the Government's project delivery team will conduct what is known as the Red Zone Meeting to discuss the close-out process, to schedule the events and review responsibilities for actions necessary to produce a timely physical, as well as fiscal, project close-out. The Red Zone meeting derives its name from the football term used to describe the team effort to move the ball the last 20 yards into the end zone. The close-out of a construction project sometimes can be equally as hard and most definitely requires the whole team's efforts.

1.39 PARTNERING

In order to most effectively accomplish this contract, the Government proposes to form a partnership with the Contractor to develop a cohesive building team. It is anticipated that this partnership would involve Project Delivery Team members from the Corps of Engineers, Program Sponsor, facility user representatives, the Contractor, primary subcontractors, and the designers.

The partnership will draw upon the strength of each organization in an effort to achieve a project that is without any safety mishaps, conforms to the Contract, stays within budget and on schedule.

The Government encourages partnering to be initiated near the beginning of the Contract and endure through the life of the Contract. This partnership would be bilateral in membership and participation will be completely voluntary.

1.39.1 Informal Partnering

An informal partnering workshop shall be held within 30 calendar days of NTP. Participants invited shall include: Corps of Engineers, Contractor, the customer/end user, primary subcontractors, the designers, Base Civil Engineer, and anyone else deemed appropriate by the Contracting Officer. Consideration should be given to inviting utility companies and permit agencies where long lead times and/or extensive work or relocations affect the Contractor's performance of the work. Schedule the Initial Partnering Session for a duration of one day, minimum. It is recommended to locate this session at a place off the construction site to avoid disturbances, as agreed to by the Contracting Officer and the Contractor. The partnering session may take place concurrently with the Pre-Construction Meeting.

Government and Contractor shall agree to utilize an independent facilitator experienced in conducting Partnering Workshops. The Facilitator is responsible for leading the team in a timely manner and making sure that issues are identified and resolved. Both the Contractor and Contracting Officer can provide suggestions for a facilitator. The facilitator shall be selected from those identified, and used as mutually agreed upon by both parties. The agenda of the workshop shall be developed by the independent approved facilitator. The Contractor and Government will evenly split the cost of the venue, facilitator fees and incidental costs. Incidental costs will be incurred by the facilitator such as handout reproductions, audio-visual equipment, highlighters, pads and other items customarily provided by, or necessary for the facilitator's use. All parties will bear their own respective labor and travel expenses. Schedule follow-on Partnering Session(s) for a maximum of four hours. Schedule them at no more than three to six month intervals. Participants are encouraged to utilize electronic means to expedite meetings. Follow-on meetings may be held at a location off-site, at the project site, or in a Government Facility.

Follow-on meetings may be held concurrently with other scheduled meetings. Attendees need only be those required to resolve current issues. As necessary, recommend using the same Facilitator from the Initial Partnering session to achieve best results and for continuity.

1.39.2 Partnering Participants

Participants shall include the Corps of Engineers, Contractor personnel, and personnel of primary subcontractors. Additionally, the following shall be invited to attend: the customer/end user, the designers, Program Sponsor, and other stakeholders deemed appropriate by the Contracting Officer. Consideration should be given to inviting utility companies and permit agencies where long lead times and/or extensive work or relocations affect the Contractor's performance of the work.

1.39.3 Follow-On Partnering Sessions

The Government encourages partnering to be initiated near the beginning of the Contract and endure through the life of the contract. Follow-on Partnering Sessions should be scheduled to be for approximately four hours in duration and on a frequency of approximately three to six month intervals, as dictated by the needs of the Project. Follow-on meetings may be held at a location off-site, at the project site, or in a Government Facility and may be scheduled for convenience, concurrent with other scheduled meetings. Attendees need only be those required to resolve current issues.

If mutually determined necessary by the Contractor and Government because of project concerns, the partnership may consider holding an additional formal partnering session. Scope and scheduling for an additional formal partnering session shall be agreed to by both the Contractor and the Government. The workshop shall be led by an independent facilitator experienced in conducting Partnering Workshops. The facilitator shall be selected as mutually agreed upon by both the Government and the Contractor. However, if a formal partnering session was already conducted, consideration should be given to utilizing the same Facilitator from the Initial Partnering session to achieve best results and for continuity.

The Contractor and Government will bear their own respective labor and travel expenses for an additional formal partnering session. The

partnering session venue will be provided by the Government, preferably at a place off the construction site to avoid disturbances. The Government will pay for costs to provide the venue, and the Contractor shall pay the costs of the independent facilitator, including fees and incidental costs such as those incurred by the facilitator for travel, handout reproduction, audio-visual equipment, highlighters, pads and other items customarily provided by, or necessary for the facilitator's use.

1.40 PROGRESS PHOTOGRAPHS

The Contractor shall furnish digital photos (in pdf) depicting the progress of the work during construction and, after final inspection by the Contracting Officer, of the conditions at the completion of the contract. Photographs need to be coordinated with NASIC customer to be taken.

The monthly photography shall be performed between the first and fifth of each month, and the PDF in RMS 3.0, with digital photos, delivered no later than the 10th of each month taken. A minimum of six views from different positions shall be taken as directed to show, inasmuch as possible, work accomplished during the previous month, and a minimum of six views shall be taken of the completed work. Additional views and positions may be required by the Contracting Officer to depict the work done.

No separate payment will be made for these services and all costs in connection thereto shall be considered a subsidiary obligation of the Contractor.

1.41 DAMAGE TO WORK

The responsibility for damage to any part of the work to be performed under this contract shall be as set forth in the clause 52.236-7 "Permits And Responsibilities" in Section 00 70 00. However, if the cofferdam(s) is constructed in accordance with plans and progress schedules approved by the Contracting Officer, but is overtopped by flood and such flood causes damage to the cofferdam(s) or if any part of the permanent work is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precaution or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such damaged work, an equitable adjustment pursuant to clause 52.243-4 "Changes" will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

1.42 NOT USED

1.43 NOT USED

1.44 NOT USED

1.45 NOT USED

1.46 NOT USED

1.47 NOT USED

1.48 FINAL CLEANING

Clean the premises in accordance with clause 52.236-12 "Cleaning Up" in Section 00 70 00 and additional requirements state here. Remove stains, foreign substances, and temporary labels from surfaces. Vacuum carpet and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace filters of operating equipment if cleaning is not possible or practicable. Remove debris from roofs, drainage systems, gutters, and downspouts. Sweep paved areas and rake clean landscaped areas. Remove waste, surplus materials, and rubbish from the site. Remove all temporary structures, barricades, project signs, fences and construction facilities. A list of completed clean-up items shall be submitted on the day of final inspection.

1.49 BASIS FOR SETTLEMENT OF PROPOSALS

Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b)"Basis for Settlement of Proposals". In evaluating a termination settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine local actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11 "Depreciation".

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

1.50 BUILDER UPDATE

Completion of BUILDER Update Form is mandatory for all projects at Wright-Patterson AFB.

BUILDER Sustainment Management System (SMS) is a DOD mandated web-based

application which is used to document the quantity and condition of all assets in all facilities across ten different Uniformat II building systems. The ten building systems which require documentation in BUILDER are: B10 Superstructure, B20 Exterior Enclosure, B30 Roofing, C10 Interior Construction, C20 Stairs, C30 Interior Finishes, D20 Plumbing, D30 HVAC, D40 Fire, and D50 Electrical. The BUILDER Update Form will capture the types and quantities of removed and installed equipment and systems that comprise the project, for the purpose of the Government transferring the relevant asset updates to the inventory within BUILDER.

The Government will furnish the Contractor with electronic versions of the BUILDER Update Form and BUILDER Update Form Instructions for the Contractor to complete the BUILDER Update Form for all assets removed or installed on the project. At 70% project completion (construction), the Contractor shall submit the Final BUILDER Update Form to the Government for review. The Final BUILDER Update Form shall be accurately completed and approved for acceptance/signature at the final acceptance/substantial completion date. Contact the Contracting Officer for any project specific information necessary to complete the BUILDER Update Form.

1.51 FINAL ACCEPTANCE TESTING

1.51.1 General

Where work involves fire suppression and/or fire alarm systems, comply with testing requirements in this section and in the applicable technical specification section(s). In the event of conflict between this section and the applicable technical specification section(s), the more stringent requirement shall govern.

1.51.2 Request for Final Acceptance Testing

At least 14 days prior to the proposed start of the Final Acceptance Test for fire suppression and/or fire alarm systems, submit a Request for Final Acceptance Testing. Include a signed memorandum from the Quality Control Manager, applicable system completion certificates, and a testing plan.

a. The Quality Control Manager shall certify the system(s) are ready for final acceptance testing. Include confirmation that each addressable are complete, and all quality control measures and preliminary tests have been successfully completed with any deficiencies resolved and re-tested.

b. Completion certificates shall include NFPA 13 Material and Test Certificate, NFPA 72 Fire Alarm System Record of Completion, and/or other similar documentation as applicable.

c. The testing plan shall identify the devices to be tested, the sequence in which they will be tested, the procedures and equipment to be used, applicable NFPA or other standards, the names and qualifications of the Contractor's installing technician(s) and/or engineer(s) who shall conduct the test, and the communication devices to be used during the test.

1.51.3 Test Administration

On the date of Final Acceptance Testing, provide one hard-copy set of as-built drawings at the project site for Government reference during the test, and provide two hard-copy sets of the applicable inspection and

testing forms for use by the Fire Department and the Contracting Officer's designated representative. Conduct the test as detailed in the testing plan.

1.52 WORK CLEARANCES AND COORDINATION

1.52.1 Digging Clearances

All excavation, trenching, soil boring, directional boring, or similar work requires advance Government approval. At least 30 days prior to the planned work, mark the site with stakes or paint, provide a detailed description and location map to the Government project inspector, and request Government preparation of an Air Force Form 103, Base Civil Engineering Work Clearance Request. The Government shall process the Form 103 to obtain coordination from utility system owners, and shall notify the Contractor of the outcome and, if approved as planned, the date upon which work is approved to proceed. Do not proceed with work prior to receipt of the completed and signed AF Form 103.

1.52.2 Building Systems Service Outages

Where work requires shutdown or modification of fire sprinklers, HVAC systems, electrical distribution, and/or other building systems or utilities, follow procedures as described above for digging clearances. The applicable system owner shall operate all controls or valves. Do not proceed with work prior to receipt of the completed and signed AF Form 103.

1.52.3 Safe Clearance from Underground Utilities

Where work is required near underground utilities, the Contractor shall physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within 3 feet of the underground system.

1.52.4 Written Notices

Submit requests for dig clearances or building system outages and Utility connections in writing to the Contracting Officer for approval at least 30 Calendar days in advance of the time required.

1.52.5 Form

It is the requesters responsibility to be on site with the 103 form in hand at the time of the marking of utilities to get the 103 signed. Work shall be started within 30 days. If not; requester/designee is responsible for removal of flags. Flags must be removed upon completion of project/dig by requester/designee. If work is not complete within 90 days a new 103 request is required. A signed copy of the 103 needs to be given to 88 CES/CSU and available on site or electronically.

1.53 HOT WORK

Hot Work is defined by NFPA 51B as work involving burning, welding, or a similar operation that is capable of initiating fires or explosions. Obtain and maintain on site a Hot Work Permit prior to performing any Hot Work. Hot Work Permits are valid for a maximum of 24 hours; longer operations require a new permit each day. Hot Work Permits shall be obtained via either of the following methods:

a. Government-issued permits: Call the WPAFB Fire and Emergency Services Flight (WPFES) Hot Work line, 937-904-3157, 24 hours (one work day) in advance and follow the instructions provided by WPFES.

b. Contractor-issued permits: Provide an individual or individuals to serve as Permit Authorizing Individual(s) (PAI), obtain training from WPFES, and have the PAI issue permits for Hot Work under this contract. Call the Fire Prevention office at 937-257-4075 to request PAI training, and provide the name and contact information of the PAI to WPFES and to the Contracting Officer's Representative. WPFES will train and provide supporting materials to the Contractor's PAI, review the area in which Hot Work will be required, and issue a Permit Authorized Designated Area letter. Once training is complete and the Permit Authorized Designated Area letter has been issued, the PAI may issue Hot Work Permits for work under this contract within that designated area.

The Contractor may, at the Contractor's option, use either of the above methods. For either method, maintain a file of all Hot Work Permits issued for work under this contract. Perform all Hot Work in accordance with NFPA 51B and the WPAFB Contractors Guide for Safeguarding Building Construction Operations from Fire Hazards. Determine site-specific hazards and appropriate fire prevention and fire protection measures. Ensure appropriate fire extinguishing equipment is readily available on site and personnel are trained in its operation. Quantity and type of extinguishing equipment shall be as determined by the Contractor but not less than one type 2A:10B:C dry chemical extinguisher nor less than as may be required by other sections of this contract. Maintain a fire watch on site for a minimum of one hour after completion of Hot Work.

1.54 CRANES AND OTHER TALL EQUIPMENT

a. For any crane or other item 30 feet tall or above, submit a Crane Usage Request at least 60 days prior to planned use. Identify the item's maximum height above ground level, the location(s) in which the item will be positioned, the expected dates of its presence, and (where applicable) any obstruction marking and lighting. Provide a crane range diagram or similar drawing depicting how the item will be configured and operated to stay at or below the identified maximum height above ground level. If the crane will be lowered when not in active use, identify the expected daily hours of operation.

b. For any crane or other item tall enough to encroach upon airfield "imaginary surfaces" as described by 14 CFR 77.21, provide obstruction marking and lighting in accordance with FAA AC 70/7460-1. Items lower than 140 feet above ground level and at least 2000 feet from the nearest runway centerline are unlikely to encroach upon airfield imaginary surfaces, but the Government shall make a determination on a case-by-case basis.

c. When the Government determines a crane or other item will encroach upon airfield imaginary surfaces, the Government shall obtain appropriate waivers to airfield criteria and shall make appropriate notifications to the Federal Aviation Administration. The Contractor shall not raise the item into position prior to receipt of Government confirmation that all applicable waivers and notifications have been completed.

1.55 LABELS

Labels shall be provided for electrical outlets and light switches. Labels shall be provided for all Mechanical Piping, HVAC Equipment, Access Doors, and Miscellaneous HVAC Equipment. Label shall be coordinated with the COR.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

-- End of Section --

SECTION 01 11 00

SUMMARY OF WORK
08/15

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes replacement of mechanical/electrical equipment associated with existing air handling unit AHU 5; distribution zone reconfiguration for area served by AHU 5; reconfiguration of floor area served by AHU 5; modifications of fire detection, fire suppression, lighting, and emergency lighting to AHU 5 area; new STP Copper and fiber optic cabling to work stations in AHU 5 area; replacement of existing Walkerflex Modular wiring connections to all work stations in AHU 5 area with new hardwire (j-box and conduit) connections; and replacement of existing lighting with LED Lighting in AHU 5 Area. Project scope consists of interior renovation work only, exterior site/civil work is not required. All work in secure areas shall be constructed in accordance with ICD 705.

1.1.2 Location

The work is located at the Wright-Patterson Air Force Base, National Air and Space Intelligence Center (NASIC), comprised of connected Buildings 10822, 10828, 10829, 10853, 10856, and 10859, approximately as indicated.

1.2 CONTRACT DRAWINGS

Refer to drawing set and index for drawing numbers and sheet count.

1.3 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

Contractor shall provide 15 day notice and allow customer to move out in 45 days.

Common access/egress corridors: Stain W5, Rooms W208, W254, W279 and W280 must be maintained as common access/egress corridors throughout the construction period for facility personnel. These rooms will be limited to contractor work (i.e. abatement, demolition, and new work as defined here-in) from the hours of 1600 to 2400. The corridors must be cleared of all construction materials and equiment during the hours of 0500 to 1600. Contractor must schedule the construction work accordingly. Contractor must coordinate with the contracting officer and security officer for all construction efforts. The following systems must be maintained and fully functional:

1. Security Intrusion Detection

2. Security Surveillance

3. Security Turnstile and all associated apparatus

4. Intercom call box at West entrance

If abatement of any area is required, all classified lines are to be removed prior to work commencing. Phasing requirements need to be spelled out by the Contractor during abatement to meet security requirements.

Contractor shall provide 4 week notice to customer for network to connection to BAS.

Contractor to modify manbars at existing louver as needed to get equipment in and out of mechanical room W299. Man bars must be put back into place at the close of business each day. Contractor to submit plan for manbars modification to NASIC for approval.

1.4 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.5 NOT USED

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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TITLE AND LOCATION
F/10856 - Replace AHU 5 (MSP Project)

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		00 80 00.00 06	SD-02 Shop Drawings															
			Mechanical/Electrical Room	1.37	G													
			Layout															
			SD-04 Samples															
			Equipment Warranty Identification	1.16	G													
			Tags															
			SD-05 Design Data															
			SF1413 Statement and	1.12														
			Acknowledgement															
			Local Agency Check	1.14														
			Progress Photographs	1.40														
			SD-07 Certificates															
			Warranty of Construction	1.16														
			NO ASBESTOS - CONTAINING	1.15	G													
			MATERIAL (ACM)															
			CERTIFICATION															
			Construction Phase	1.15.2														
			Certification for each individual	1.15.2	G													
			product installed and identified to															
			contain mineral fibers that no															
			asbestos-containing materials															
			were installed															

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		00 80 00.00 06	Documentation to show that the	1.15.2	G													
			products containing mineral fiber															
			materials have been															
			microscopically examined by an															
			AIHA- or NVLAP-certified															
			laboratory and the lab has															
			determined that the material does															
			not contain asbestos															
			Insurance	1.31														
			Sales and Use Tax	1.29														
			SD-11 Closeout Submittals															
			Preliminary (Working) As-Built	1.7.4	G													
			Drawings															
			Final As-Built Drawings	1.7.1	G													
			CAD Working As-Built Drawings	1.7.1.2	G													
			Equipment-in-Place List	1.9.1														
			Maintenance and Parts Data	1.9.1														
			Warranty Management Plan	1.16	G													
			Completion of BUILDER Update	1.50	G													
			Form															
		01 32 01.00 06	SD-01 Preconstruction Submittals															
			Preliminary Project Schedule	3.4.1	G													
			Project Schedule	3.4	G													
			Project Scheduler Qualifications	1.3	G													
			SD-05 Design Data															
			Narrative Report	3.5.2														

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		01 32 01.00 06	Schedule Reports	3.5.4														
			Periodic Schedule Updates	3.4.4	G													
		01 32 52	SD-01 Preconstruction Submittals															
			Contractor's Security Officer	1.4.1	G													
			Contractor Security Officer	1.4.2	G													
			Assistants															
			Entry Authorization List	1.6.2.1	G													
		01 33 00	SD-01 Preconstruction Submittals															
			Submittal Register	1.8	G													
		01 35 26.00 06	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.7														
			Fatigue Management Plan	1.7														
			Bloodborne Pathogen Plan	1.7														
			Exposure Control Plan	1.7														
			Hearing Conservation Program	1.7														
			Respiratory Protection Plan	1.7														
			Health Hazard Control Program	1.7														
			Hazard Communication Program	1.7														
			Asbestos Abatement Plan &	1.7														
			Specifications															
			Heat Stress Monitoring Plan	1.7														
			Cold Stress Monitoring Plan	1.7														
			Indoor Air Quality Management	1.7														
			Plan															
			Mold Remediation Plan	1.7														
			Crystalline Silica Assessment	1.7														

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		01 35 26.00 06	Fire Prevention Plan	1.7														
			Hazardous Energy Control Plan	1.7														
			Standard Pre-Lift Plan (LHE)	1.7														
			Critical Lift Plan - LHE	1.7														
			Fall Protection and Prevention	1.7														
			Plan															
			Demolition/Renovation Plan (to	1.7														
			include engineering survey)															
			Confined Space Entry	1.7														
			Procedures															
			Confined Space Program	1.7														
			Activity Hazard Analysis (AHA)	1.8	G	RO												
			Site Safety and Health Officer	1.5.1.1	G	RO												
			Qualifications(SSHO)															
			Proof of qualification for Crane	1.12.7	G	RO												
			Operators															
			Critical Lift Plan	1.12.7	G	RO												
			SD-06 Test Reports															
			Reports	1.12														
			Accident Reports	1.12.1														
			Monthly Exposure Reports	1.12.3														
			Crane Reports	1.12.5														
			Regulatory Citations and	1.12.4														
			Violations															
			SD-07 Certificates															
			Confined Space Entry Permit	1.12.8														

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		01 35 26.00 06	Hot work permit	1.13														
			Crane Certificate of Compliance	1.12.6														
		01 35 43	SD-01 Preconstruction Submittals															
			Environmental Coordinator	1.4.3														
			Designation and Application for															
			RCRA Training															
			Ohio EPA Notification of	3.1.1														
			Demolition and															
			Renovation/Abatement															
			Asbestos Work Plan	3.1.2	G													
			Fuel-Fired Equipment Startup															
			Information															
			HAZMAT Inventory	3.6.2														
			WPAFB Worksheet 1433 -	3.7.2														
			Hazardous Waste Storage Permit															
			SD-06 Test Reports															
			Asbestos Abatement Clearance	3.1.4														
			Air Sampling Report															
			HVAC System Water Analysis	3.2.6	G													
			Quarterly Recycling and Solid	3.5.3														
			Waste Summary Report															
			Refrigerant Record	3.6.5														
			SD-07 Certificates															
			Certification of Recovered and	1.5.2														
			Biobased Products															

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		01 35 43	Section 608 Technician	3.6.5														
			Certification															
			Refrigerant Recovery Equipment	3.6.5														
			Certification															
			Certificate of Conformity	3.1.9														
			STI SP001 Inspector's Training	3.8														
			Certification															
			SD-11 Closeout Submittals															
			Green Products Determination	1.5.3														
			Form (GPDF)															
			Notice of Termination (NOT)	3.2.3														
		01 45 04.10 06	SD-01 Preconstruction Submittals															
			Construction Quality Control Plan	3.3		G RO												
		01 46 00.00 06	SD-01 Preconstruction Submittals															
			Commissioning Specialists	1.4		G DO												
			Commissioning Specialists	1.4.2		G DO												
			Project Schedule	1.8		G DO												
			SD-06 Test Reports															
			Construction Phase	3.1.3		G DO												
			Commissioning Plan															
			PVT Procedures	3.1.5.4		G DO												
			PVT Report	3.1.5.4		G DO												
			Issues Log	1.6														
			Trend Log Report	3.1.5.5														
			Commissioning Report	3.6		G DO												
			SD-07 Certificates															

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		01 46 00.00 06	Certificate of Readiness	1.7	G	DO												
			SD-10 Operation and Maintenance															
			Data															
			Systems Training	3.2	G	DO												
			Training Plan	3.3	G	RO												
			Training Attendance Rosters	3.3	G	RO												
			Systems Manual	3.4	G	DO												
			Maintenance and Service Life	3.5	G	DO												
			Plans															
		01 50 00	SD-01 Preconstruction Submittals															
			Construction Site Plan	1.3	G													
			Traffic Control Plan	3.3.1	G													
			Haul Road Plan		G													
			Contractor Computer	1.5.1.4	G													
			Cybersecurity Compliance															
			Statements															
			Contractor Temporary Network	1.5.6	G													
			Cybersecurity Compliance															
			Statements															
		01 74 19	SD-01 Preconstruction Submittals															
			Construction Waste Management	1.7	G													
			Plan															
			SD-06 Test Reports															
			Quarterly Reports	1.9.2														
			Annual Report	1.9.3														
			SD-11 Closeout Submittals															

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		01 74 19	Final Construction Waste	1.10	S													
			Diversion Report															
		01 78 23	SD-10 Operation and Maintenance															
			Data															
			O&M Database	1.4	G													
			Training Plan	3.1.1	G													
			Training Outline	3.1.3	G													
			Training Content	3.1.2	G													
			SD-11 Closeout Submittals															
			Training Video Recording	3.1.4	G													
			Validation of Training Completion	3.1.6	G													
		02 41 00	SD-01 Preconstruction Submittals															
			Existing Conditions	1.9	G													
			SD-07 Certificates															
			Deconstruction Plan	1.2.1	G													
			Notification	1.6	G													
			SD-11 Closeout Submittals															
			Receipts	3.2.2														
		04 20 00	SD-03 Product Data															
			Hot Weather Procedures	1.5.1														
			Cold Weather Procedures	1.5.2														
			Cement	2.2.2.1.1														
			Cementitious Materials	2.4.1.1														
			SD-05 Design Data															
			Fire-Rated Concrete Masonry	2.2.2.2														
			Units															

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		04 20 00	SD-06 Test Reports															
			Fire-Rated Concrete Masonry	2.2.2.2														
			Units															
			SD-07 Certificates															
			Concrete Masonry Units (CMU)	2.2.2.1														
			Admixtures for Masonry Mortar	2.4.1.3														
			Admixtures for Grout	2.4.2.2														
			Joint Reinforcement	2.6.3														
			SD-08 Manufacturer’s Instructions															
			Admixtures for Masonry Mortar	2.4.1.3														
			Admixtures for Grout	2.4.2.2														
		06 10 00	SD-03 Product Data															
			Fire-retardant Treatment	1.5														
			Adhesives	2.2.2														
		07 21 16	SD-03 Product Data															
			Blanket Insulation	2.1														
			Accessories	2.3														
			SD-08 Manufacturer’s Instructions															
			Insulation	3.3.1														
		07 84 00	SD-02 Shop Drawings															
			Firestopping System	2.1	G													
			SD-03 Product Data															
			Firestopping Materials	2.2	G													
			SD-06 Test Reports															
			Inspection	3.3														
			SD-07 Certificates															

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		07 84 00	Inspector Qualifications	1.5.2														
			Firestopping Materials	2.2														
			Installer Qualifications	1.5.1	G													
		07 92 00	SD-03 Product Data															
			Sealants	2.1														
			Primers	2.2														
			Bond Breakers	2.3														
			Backstops	2.4														
			SD-06 Test Reports															
			Field Adhesion	3.1														
		08 11 13	SD-02 Shop Drawings															
			Doors	2.1	G													
			Frames	2.3	G													
			SD-03 Product Data															
			Doors	2.1	G													
			Frames	2.3	G													
			Accessories	1.3														
		08 31 00	SD-02 Shop Drawings															
			Access Doors And Panels	1.3	G													
			SD-03 Product Data															
			Access Doors And Panels	1.3	G													
			Hardware	1.3.1	G													
			Accessories	2.2.8	G													
			SD-04 Samples															
			Finishes	2.5	G													
		08 34 73	SD-02 Shop Drawings															

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		08 34 73	Fabrication Drawings	2.1														
			SD-03 Product Data															
			Hollow Metal Sound Retardant	2.2.1	G													
			Doors															
			Door Frames	2.1	G													
			Door Hardware	2.3.5	G													
			Door Frame Sound Infill	2.3.2	G													
			Thresholds	2.3.8	G													
			SD-06 Test Reports															
			Acoustical Tests	2.4.2	G													
			SD-07 Certificates															
			Hollow Metal Sound Retardant	2.2.1														
			Doors															
			Door Frames	2.1														
			Door Hardware	2.3.5														
			Thresholds	2.3.8														
		08 71 00	SD-02 Shop Drawings															
			Manufacturer's Detail Drawings	1.3	G													
			Verification of Existing Conditions	1.3	G													
			Hardware Schedule	1.5	G													
			Keying System	2.3.6	G													
			SD-03 Product Data															
			Hardware Items	2.3	G													
			SD-08 Manufacturer’s Instructions															
			Installation	3.1														

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		08 71 00	SD-10 Operation and Maintenance															
			Data															
			Hardware Schedule	1.5	G													
			SD-11 Closeout Submittals															
			Key Bitting	1.6.1														
		09 22 00	SD-02 Shop Drawings															
			Metal Support Systems	2.1														
			SD-03 Product Data															
			Metal Support Systems	2.1														
		09 23 00	SD-03 Product Data															
			Gypsum Base Coat Plaster	2.2														
			Gypsum Finish Coat Plaster	2.3														
			SD-04 Samples															
			Sample Panel	1.3.1	G													
			SD-08 Manufacturer’s Instructions															
			Ready-Mix Gypsum Plaster	2.7														
		09 29 00	SD-03 Product Data															
			Accessories	2.1.5														
			Gypsum Board	2.1.1														
			SD-06 Test Reports															
			ASTM E90 Factory Test Report	3.6														
			SD-07 Certificates															
			Asbestos Free Materials	2.1														
			SD-08 Manufacturer’s Instructions															
			Safety Data Sheets	2.1														

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		09 29 00	SD-10 Operation and Maintenance															
			Data															
			Manufacturer Maintenance	2.1														
			Instructions															
		09 51 00	SD-02 Shop Drawings															
			Approved Detail Drawings	2.1	G													
			SD-03 Product Data															
			Recycled Content for Type III	2.2.1.1	S													
			Ceiling Tiles															
			Acoustical Performance	2.1.1	G													
			SD-04 Samples															
			Acoustical Ceiling Tiles	2.2.1.1														
			SD-07 Certificates															
			Indoor Air Quality for Type III	2.2.1.1	S													
			Ceiling Tiles															
			Indoor Air Quality for Adhesives	2.5														
			Indoor Air Quality for Sealants	2.8														
		09 67 23.13	SD-02 Shop Drawings															
			Installation Drawings	2.1	G													
			Fabrication Drawings	2.1	G													
			SD-03 Product Data															
			Manufacturer's Catalog Data	1.2.2	G													
			SD-04 Samples															
			Hardboard Mounted Epoxy	1.5.3	G													
			Flooring															
			Floor Topping	3.1.4	G													

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		09 67 23.13	Mockups	1.5.1	G													
			SD-05 Design Data															
			Design Mix Data	1.2.3	G													
			SD-07 Certificates															
			Listing of Product Installations	1.5.2														
			Referenced Standards	1.5														
			Certificates															
			SD-11 Closeout Submittals															
			Warranty	1.6	G													
		09 68 00	SD-02 Shop Drawings															
			Installation Drawings	3.2														
			SD-03 Product Data															
			Carpet	2.1														
			Recycled Content for Carpeting	2.1.1														
			Moldings	2.4														
			Indoor Air Quality for Non-Aerosol	2.3														
			Adhesives															
			Indoor Air Quality for Concrete	2.3														
			Primer															
			SD-04 Samples															
			Carpet	2.1														
			Moldings	2.4														
			SD-07 Certificates															
			Indoor Air Quality for Carpet	2.1.2														
			SD-08 Manufacturer's Instructions															
			Surface Preparation	3.1														

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		09 68 00	SD-10 Operation and Maintenance															
			Data															
			Cleaning and Protection	3.3														
			Maintenance Service	3.5.2														
			SD-11 Closeout Submittals															
			Warranty	1.6														
		09 84 00	SD-03 Product Data															
			Acoustical Sound Barrier	3.2.2	G													
			SD-08 Manufacturer’s Instructions															
			Installation Instructions	3.2.1														
		09 84 20	SD-02 Shop Drawings															
			Approved Detail Drawings	2.2	G													
			SD-03 Product Data															
			Installation	3.2														
			Acoustical Wall Panels	2.2	G													
			Bio-Based Content for Fabric	2.1.1.1														
			Panels															
			SD-04 Samples															
			Acoustical Wall Panels	2.2	G													
			SD-07 Certificates															
			Acoustical Wall Panels	2.2														
			SD-11 Closeout Submittals															
			Warranty	1.4														
		09 90 00	SD-02 Shop Drawings															
			Piping Identification	3.7														
			SD-03 Product Data															

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		09 90 00	Coating	2.1														
			Product Data Sheets	2.1														
			SD-04 Samples															
			Color	2.2														
			SD-07 Certificates															
			Qualification Testing	1.6.6.2														
			Indoor Air Quality for Paints and	1.6.5														
			Primers															
			Indoor Air Quality for	1.6.5														
			Consolidated Latex Paints															
			SD-08 Manufacturer’s Instructions															
			Mixing	2.1														
			Manufacturer's Safety Data	1.8.1														
			Sheets															
			SD-10 Operation and Maintenance															
			Data															
			Coatings	2.1	G													
		10 14 00.20	SD-02 Shop Drawings															
			Detail Drawings	1.4.2	G													
			SD-03 Product Data															
			Room Identification and	2.1	G													
			Directional Signage System															
			SD-04 Samples															
			Interior Signage	1.4.1	G													
			Software	1.3														

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		10 14 00.20	Room Identification and	2.1														
			Directional Signage System															
			SD-10 Operation and Maintenance															
			Data															
			Approved Manufacturer's	3.1	G													
			Instructions															
			Protection and Cleaning	3.1.2	G													
		10 26 00	SD-02 Shop Drawings															
			Corner Guards	2.2														
			SD-03 Product Data															
			Corner Guards	2.2														
			SD-04 Samples															
			Corner Guards	2.2														
			SD-06 Test Reports															
			Fire Resistance Rating	2.1.1.2														
			SD-07 Certificates															
			Indoor air quality for adhesives	2.5														
			SD-10 Operation and Maintenance															
			Data															
			Corner Guards	2.2	G													
		10 44 16	SD-02 Shop Drawings															
			Fire Extinguishers	2.1.1														
			Accessories	Part 2														
			Wall Brackets	Part 2														
			Schedule	1.5														
			SD-03 Product Data															

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		10 44 16	Fire Extinguishers	2.1.1														
			Accessories	Part 2														
			Wall Brackets	Part 2														
			Replacement Parts List	3.2.1														
			SD-04 Samples															
			Equipment Samples	1.3.1														
			SD-07 Certificates															
			Fire Extinguishers Certifications	2.1.1														
			Manufacturer's Warranty with	1.4														
			Inspection Tag															
		12 50 00.13 10	SD-01 Preconstruction Submittals															
			Storage Location	1.7.3	G													
			SD-02 Shop Drawings															
			Installation Drawings	3.3.1	G													
			Grommet	3.3.1	G													
			SD-03 Product Data															
			Product Data	2.3	G													
			Product Style Options	2.3	G													
			SD-04 Samples															
			Fabric and Finishes	2.3.5	G													
			SD-07 Certificates															
			Authorized Dealer	1.6	G													
			Certified Furniture Installers	1.6	G													
			Licensed Electrician	1.6	G													
			Certified Telecommunications	1.6	G													
			Installer															

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		12 50 00.13 10	Manufacturer's Certification	2.3	G													
			Warranty	1.8	G													
			SD-10 Operation and Maintenance															
			Data															
			Furniture, Data Package 1	3.5	G													
			SD-11 Closeout Submittals															
			Energy Efficient Equipment	2.1.1														
			Reduced VOC's for Furniture	2.1.2														
			Recycled Content of Furniture	2.1.3														
			Bio-Based Content of Furniture	2.1.4														
		12 59 00	SD-02 Shop Drawings															
			Detail Drawings	1.4.4	G													
			SD-03 Product Data															
			Warranty	1.6	G													
			Workstations	2.2.1														
			Power and Communications	2.11														
			Communications	2.11.8														
			Recycled Content for system	2.1														
			furniture components															
			Energy Star Label for Task	2.11.7														
			Lighting															
			SD-04 Samples															
			Workstations	2.2.1	G													
			Mock-up	2.2.3	G													
			Samples	2.2.2														
			SD-06 Test Reports															

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		12 59 00	Selected Components	2.2.5.1	G													
			Panel Acoustics	2.2.5.2	G													
			Fire Safety	1.4.2	G													
			Electrical System	1.4.3	G													
			SD-07 Certificates															
			Workstations	2.2.1														
			SD-10 Operation and Maintenance															
			Data															
			Assembly Manuals	2.3.1	G													
			Maintenance Manuals	3.2	G													
			Cleaning	3.2	G													
			Electrical System	1.4.3	G													
			Maintenance Agreements	1.7														
			Installation	3.1	G													
		21 13 13	SD-01 Preconstruction Submittals															
			Qualified Fire Protection Engineer	1.2.3	G													
			(QFPE)															
			Sprinkler System Designer	1.4.2.1	G													
			Sprinkler System Installer	1.4.2.2	G													
			SD-02 Shop Drawings															
			Shop Drawing	1.2.1.1	G													
			SD-03 Product Data															
			Pipe	2.2.1.1	G													
			Fittings	2.2.1.2	G													
			Valves	2.1.4	G													
			Sprinklers	2.3	G													

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		21 13 13	Pipe Hangers and Supports	2.2.3	G													
			Nameplates	2.1.2	G													
			SD-05 Design Data															
			Hydraulic Calculations	1.2.1.2	G													
			SD-06 Test Reports															
			Test Procedures	3.5.1	G													
			SD-07 Certificates															
			Verification of Compliant	3.5.2.1	G													
			Installation															
			Request for Government Final	3.5.2.2	G													
			Test															
			SD-10 Operation and Maintenance															
			Data															
			Operating and Maintenance	3.7	G													
			(O&M) Instructions															
			Spare Parts	1.6	G													
			SD-11 Closeout Submittals															
			As-built drawings	3.7														
		23 03 00.00 20	SD-03 Product Data															
			Equipment Labels	2.2	G													
			Pipe Labels	2.4	G													
			Duct Labels	2.4	G													
		23 05 48.00 40	SD-02 Shop Drawings															
			Installation Drawings	1.2														
			Outline Drawings	1.2														
			SD-03 Product Data															

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		23 05 48.00 40	Equipment and Performance	1.2	G													
			Data															
			Isolators	1.2	G RO													
			SD-05 Design Data															
			Bracing For Force Protection	2.4	G													
		23 05 93.00 06	SD-02 Shop Drawings															
			TAB Schematic Drawings and	3.3	G													
			Report Forms															
			SD-03 Product Data															
			TAB Related HVAC Submittals	3.2														
			TAB Procedures	3.5.1	G													
			Calibration	1.4														
			Systems Readiness Check	3.5.2														
			TAB Execution	3.5.1	G													
			TAB Verification	3.5.4	G													
			SD-06 Test Reports															
			Design Review Report	3.1	G													
			Systems Readiness Check	3.5.2	G													
			TAB Report	3.5.3	G													
			TAB Verification Report	3.5.4	G													
			SD-07 Certificates															
			Ductwork Leak Testing	3.4														
			TAB Firm	1.5.1	G													
			TAB Specialist	1.5.2	G													
		23 07 00	SD-02 Shop Drawings															
			MICA Plates	3.2.2.4														

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		23 07 00	Pipe Insulation Systems	2.3														
			Duct Insulation Systems	3.3														
			Equipment Insulation Systems	3.4														
			Recycled content for insulation	2.3.1														
			materials															
			SD-03 Product Data															
			Pipe Insulation Systems	2.3	G													
			Duct Insulation Systems	3.3	G													
			Equipment Insulation Systems	3.4	G													
			SD-04 Samples															
			Thermal Insulation	2.2.1.3														
			Display Samples	3.1.1	G RO													
			SD-07 Certificates															
			Indoor air quality for adhesives	2.2.1														
			SD-08 Manufacturer’s Instructions															
			Pipe Insulation Systems	2.3														
			Duct Insulation Systems	3.3														
			Equipment Insulation Systems	3.4														
		23 09 00	SD-02 Shop Drawings															
			DDC Contractor Design Drawings	3.2	G													
			Draft As-Built Drawings	3.2	G RO													
			Final As-Built Drawings	3.2	G RO													
			SD-03 Product Data															
			Programming Software	1.8.3	G													
			Controller Application Programs	1.8.4	G													
			Configuration Software	1.8.1	G													

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		23 09 00	Controller Configuration Settings	1.8.2	G													
			Manufacturer's Product Data	2.2	G													
			SD-06 Test Reports															
			Start-Up Testing Report	3.4.2	G	RO												
			PVT Procedures	3.5.1	G	RO												
			PVT Report	3.5.3	G	RO												
			Pre-Construction Quality Control	1.9.1	G	RO												
			(QC) Checklist															
			Post-Construction Quality Control	1.9.2	G	RO												
			(QC) Checklist															
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.6	G	RO												
			(O&M) Instructions															
			Training Documentation	3.8.1	G	RO												
			SD-11 Closeout Submittals															
			Enclosure Keys	2.5	G	RO												
			Closeout Quality Control (QC)	1.9.3	G	RO												
			Checklist															
		23 30 00	SD-02 Shop Drawings															
			Detail Drawings	1.4.4	G													
			SD-03 Product Data															
			Metal Duct	2.8.5.1														
			Metallic Flexible Duct	2.8.1.2														
			Insulated Nonmetallic Flexible	2.8.1.3	G													
			Duct Runouts															

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		23 30 00	Duct Connectors	2.8.1.3	G													
			Duct Access Doors	2.8.2	G													
			Manual Balancing Dampers	2.8.3	G													
			Sound Attenuation Equipment	2.8.5														
			Diffusers	2.8.6.1	G													
			Registers and Grilles	2.8.6.2	G													
			Gravity Hoods	2.8.7	G													
			In-Line Centrifugal Fans	2.9.1.2														
			Air Handling Units	2.10	G													
			Variable Volume, Single Duct	2.12.1.1	G													
			Terminal Units															
			Reheat Units	2.12.1.2	G													
			Unit Heaters	2.13	G													
			Test Procedures	1.4.5														
			Indoor Air Quality for Duct	2.8.1														
			Sealants															
			SD-06 Test Reports															
			Performance Tests	3.12	G RO													
			Damper Acceptance Test	3.10	G RO													
			Start-Up Reports	3.12.2	G RO													
			SD-08 Manufacturer’s Instructions															
			Manufacturer's Installation	3.2														
			Instructions															
			Operation and Maintenance	3.14.2														
			Training															

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		23 30 00	SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.14.1	G	RO												
			Manuals															
			Manual Balancing Dampers	2.8.3	G	RO												
			Air Handling Units	2.10	G	RO												
			Variable Volume, Single Duct	2.12.1.1	G	RO												
			Terminal Units															
			Unit Heaters	2.13	G	RO												
			SD-11 Closeout Submittals															
			Indoor Air Quality During	3.13														
			Construction															
		23 64 26	SD-02 Shop Drawings															
			Coordination Drawings	1.2	G													
			SD-03 Product Data															
			Piping and Fittings	2.2.2	G													
			Valves	2.4	G													
			Calibrated Balancing Valves	2.4.5	G													
			Pressure Relief Valve	2.4.6	G													
			Combination Pressure and	2.4.7	G													
			Temperature Relief Valves															
			Expansion Joints	3.1.11	G													
			SD-06 Test Reports															
			Piping Welds NDE Report	3.1.1.3														
			Pressure Tests Reports	3.4.2	G													
			SD-07 Certificates															

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		23 64 26	Employer's Record Documents	3.1.1.1														
			(For Welding)															
			Welding Procedures and	3.1.1.2														
			Qualifications															
			SD-10 Operation and Maintenance															
			Data															
			Calibrated Balancing Valves	2.4.5	G													
			Pressure Relief Valve	2.4.6	G													
			Combination Pressure and	2.4.7	G													
			Temperature Relief Valves															
			Expansion Joints	3.1.11	G													
		25 10 10	SD-02 Shop Drawings															
			EMCS Contractor Design	3.1.2	G													
			Drawings															
			Draft As-Built Drawings	3.1.3	G	RO												
			Final As-Built Drawings	3.1.3	G	RO												
			SD-03 Product Data															
			Product Data Sheets	2.1.5	G													
			Computer Software	2.3	G	RO												
			Enclosure Keys	2.5.1														
			SD-05 Design Data															
			EMCS IP Network Bandwidth	3.1.1	G	RO												
			Usage Estimate															
			SD-06 Test Reports															
			Pre-Construction QC Checklist	1.6	G	RO												
			Post-Construction QC Checklist	1.6	G	RO												

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		25 10 10	PVT Phase I Procedures	3.6.1	G	RO												
			PVT Phase I Report	3.6.2	G	RO												
			PVT Phase II Report	3.6.3	G	RO												
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	1.7	G	RO												
			(O&M) Instructions															
			Preventive Maintenance Work	3.7.7.1	G	RO												
			Plan															
			Basic Training Documentation	3.8.1	G	RO												
			Advanced Training	3.8.1	G	RO												
			Documentation															
			Refresher Training	3.8.1	G	RO												
			Documentation															
			SD-11 Closeout Submittals															
			Closeout QC Checklist	1.6	G	RO												
		26 20 00	SD-02 Shop Drawings															
			Panelboards	2.13	G													
			Transformers	2.15	G													
			Cable Trays	2.4	G													
			Wireways	2.25	G													
			SD-03 Product Data															
			Receptacles	2.12	G													
			Circuit Breakers	2.13.3	G													
			Switches	2.10	G													
			Transformers	2.15	G													

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		26 20 00	Motor Controllers	2.17	G													
			Manual Motor Starters	2.18	G													
			Surge Protective Devices	2.26	G													
			Cable Trays	2.4	G													
			SD-05 Design Data															
			Cable Tray Design	2.4	G													
			SD-06 Test Reports															
			600-volt Wiring Test	3.5.2	G													
			Transformer Tests	3.5.3	G													
			Ground-fault Receptacle Test	3.5.4	G													
			SD-07 Certificates															
			Fuses	2.11	G													
			SD-09 Manufacturer’s Field															
			Reports															
			Transformer Factory Tests	2.28.1														
			SD-10 Operation and Maintenance															
			Data															
			Electrical Systems	1.5.1	G													
		26 28 01.00 10	SD-03 Product Data															
			Fault Current Analysis	2.1														
			System Coordinator	1.4.1														
			Arc-Flash Hazard Analysis	2.2														
		26 29 23	SD-02 Shop Drawings															
			Schematic Diagrams	1.5.1	G													
			Interconnecting Diagrams	1.5.2	G													
			Installation Drawings	1.5.3	G													

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		26 29 23	SD-03 Product Data															
			Adjustable Speed Drives	2.1	G													
			Wires and Cables	2.3														
			Equipment Schedule	1.5.4														
			SD-06 Test Reports															
			ASD Test	3.3.1														
			Performance Verification Tests	3.3.2														
			Endurance Test	3.3.3														
			SD-08 Manufacturer’s Instructions															
			Installation instructions	1.5.5														
			SD-09 Manufacturer’s Field															
			Reports															
			ASD Test Plan	2.5.1	G													
			Standard Products	1.5.6														
			SD-10 Operation and Maintenance															
			Data															
			Adjustable Speed Drives	2.1														
		26 51 00	SD-02 Shop Drawings															
			Luminaire Drawings	1.5.1	G													
			Occupancy/Vacancy Sensor	1.5.7	G													
			Coverage Layout															
			Sequence of Operation for	2.5.1	G													
			Lighting Control System															
			SD-03 Product Data															
			Luminaires	2.2	G													
			Light Sources	2.3	G													

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		26 51 00	LED Drivers	2.4	G													
			Luminaire Warranty	1.6.1	G													
			Local Area Controller	2.5.1.1.1	G													
			Switches	2.5.2.1	G													
			Wall Box Dimmers	2.5.2.2	G													
			Occupancy/Vacancy Sensors	2.5.2.3	G													
			Power Packs	2.5.2.3.4	G													
			Power Hook Luminaire Hangers	2.7.4	G													
			Exit Signs	2.6.1	G													
			SD-06 Test Reports															
			ANSI/IES LM-79 Test Report	1.5.3	G													
			ANSI/IES LM-80 Test Report	1.5.4	G													
			ANSI/IES TM-21 Test Report	1.5.5	G													
			Occupancy/Vacancy Sensor	3.2.1.1	G													
			Verification Test															
			SD-07 Certificates															
			LED Driver and Dimming Switch	1.5.6	G													
			Compatibility Certificate															
		27 10 00	SD-02 Shop Drawings															
			Telecommunications Drawings	1.6.1.1	G													
			Telecommunications Space	1.6.1.2	G													
			Drawings															
			SD-03 Product Data															
			Telecommunications Cabling	2.3	G													
			Telecommunications	2.4	G													
			Outlet/Connector Assemblies															

SUBMITTAL REGISTER

CONTRACT NO. W912QR23R0022_CUI_Specs-0000

TITLE AND LOCATION
F/10856 - Replace AHU 5 (MSP Project)

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		27 10 00	SD-06 Test Reports															
			Telecommunications Cabling	3.5.1	G													
			Testing															
			SD-07 Certificates															
			Telecommunications Contractor	1.6.2.1	G													
			Key Personnel	1.6.2.2	G													
			Manufacturer Qualifications	1.6.2.3	G													
			Test Plan	1.6.3	G													
			SD-09 Manufacturer’s Field															
			Reports															
			Factory Reel Tests	2.9.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Telecommunications Cabling and	1.10.1	G													
			Pathway System															
			SD-11 Closeout Submittals															
			Record Documentation	1.10.2	G													
		28 31 76	SD-01 Preconstruction Submittals															
			Qualified Fire Protection Engineer	1.3.2	G													
			(QFPE)															
			Fire alarm system designer	1.9.2.1	G													
			Supervisor	1.9.2.2	G													
			Technician	1.9.2.3	G													
			Installer	1.9.2.4	G													
			Test Technician	1.9.2.5	G													

SUBMITTAL REGISTER

CONTRACT NO. W912QR23R0022_CUI_Specs-0000

TITLE AND LOCATION
F/10856 - Replace AHU 5 (MSP Project)

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 76	Fire Alarm System Site-Specific	1.7	G													
			Software Acknowledgement															
			SD-02 Shop Drawings															
			Nameplates	1.9.1.3	G													
			Instructions	3.10.3	G													
			Wiring Diagrams	1.9.1.4	G													
			System Layout	1.9.1.5	G													
			Notification Appliances	1.9.1.6	G													
			Initiating devices	1.9.1.7	G													
			Amplifiers	1.9.1.8	G													
			Battery Power	1.9.1.9	G													
			Voltage Drop Calculations	1.9.1.10	G													
			SD-03 Product Data															
			Amplifiers	1.9.1.8	G													
			Tone Generators	2.3	G													
			Digitalized voice generators	2.3	G													
			Smoke Detectors	2.4	G													
			Duct Smoke Detectors	2.4.2	G													
			Heat Detectors	2.5.1	G													
			Addressable Interface Devices	2.6	G													
			Addressable Control Modules	2.7	G													
			Notification Appliances	1.9.1.6	G													
			Batteries	2.10.1	G													
			Battery Chargers	2.10.2	G													
			Supplemental Notification	2.10.1.1	G													
			Appliance Circuit Panels															

SUBMITTAL REGISTER

CONTRACT NO. W912QR23R0022_CUI_Specs-0000

TITLE AND LOCATION
F/10856 - Replace AHU 5 (MSP Project)

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 76	Auxiliary Power Supply Panels	2.10.1.1	G													
			Surge Protective Devices	2.11	G													
			Alarm Wiring	2.12.1	G													
			Back Boxes and Conduit	3.3.4	G													
			Ceiling Bridges	3.2.4	G													
			Terminal Cabinets	3.3.2	G													
			SD-06 Test Reports															
			Test Procedures	3.7.1	G													
			SD-07 Certificates															
			Verification of Compliant	3.7.2.1	G													
			Installation															
			Request for Government Final	3.7.2.2	G													
			Test															
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.9	G													
			(O&M) Instructions															
			Instruction of Government	3.10	G													
			Employees															
			SD-11 Closeout Submittals															
			As-Built Drawings	1.9.1.13														
			Spare Parts	3.11.2														

Master Contractor Access List Template – This is for access to our facility. If an individual's name, driver license number, and employer are not on this sheet before arrival, they will not gain access to the facility that day. The Prime contractor will manage a master list for all of their employees and subs. Updated list will be sent to the CE project manager with the user's construction coordinator copied.

Three Week Look Ahead Template (3WLA**) –** This details all the work that is planned by the contractor three weeks in advance. This is important to make sure rooms have been coordinated and sanitized for access. It also helps us assure we will have available the escorts needed for that day's work. Access to rooms that were not properly noted ahead of time on the 3WLA may not be made available in time for work. The Prime contractor will be responsible for detailing all the work happening on site and provide a 3WLA three weeks prior of the planned work. All 3WLAs will be sent to the CE project manager with the user's construction coordinator copied.

WALL PENETRATION REQUEST FORM – This is required any time work will create a new opening in a wall or re-open an existing one. The request form should also be accompanied by a floor plan showing where the work will be performed. This request will need to be approved by the user's construction coordinator, escort team and physical security group prior to the work starting. Request should be submitted three weeks in advance to allow time for approvals. The Prime will send all request to the CE project manager with the user's construction coordinator copied.

Additionally, all penetrations must be closed up to meet ICD 705 and inspected by the user's physical security group before the end of shift. This includes having the grounding in place prior to inspection. Inspections can only be supported between 0800 – 2000 hours during weekdays. Special request for inspections outside of these times can be made, but approval is rare.

Fire Alarm Test – Any test that will require audio or visual activation of the fire alarm or any building emergency notification system must be requested three weeks in advance. These tests can only be scheduled for the 1st or 3rd Tuesday of every month and can't start until after 1800 hours. The Prime will send all request to the CE project manager with the user's construction coordinator copied.

Outages & Closures – Any utility outages or closures to parts of the building must be requested two weeks in advance. The Prime will send all request to the CE project manager with the user's construction coordinator copied. Also, any outage that would result in a fire watch can only be performed on first shift (0700 – 1600 hours). Additionally, based on the level of impact an outage or closure would have on the mission, the using group may require that work be performed on nights or weekends.

ZHTV - Project Name in Facility 10856
(Project Description)
Prime: VCC Gov. POC: Zinck/Gillson

Last	First	MI	Driver's License	Company	Notes

ZHTV 18 1986 - Repair Arbitrary & Generic Project Name Assigned by Base
(What Everyone Else Call the Project)
Prime: Dayton Management Services Gov. POC: Fain/Zinck V.2018/01/19

15-Jan

Monday, January 15, 2018 Total: 5 Day, 3 Night

Name	Day	Night	Location	Duration	*	Description
Electrician	2		W151	8 hr.		Run Conduit
Mechanical	3		N109	1 hr.		Install Ductwork
Drywall		1	W151	8 hr.		Hang new drywall
Electrician		2	N109	2 hr.		Install Comm

Tuesday, January 16, 2018 Total: 5 Day, 3 Night

Name	Day	Night	Location	Duration	*	Description
Electrician	2		W151	8 hr.		Run Conduit
Mechanical	3		N109	1 hr.		Install Ductwork
Sprinkler		1	W151	8 hr.	M, F	Install new sprinkler
Electrician		2	N109	2 hr.		Install Comm

Wednesday, January 17, 2018 Total: 6 Day, 4 Night

Name	Day	Night	Location	Duration	*	Description
Prime Contractor	1	1	W151, N109, W151	8 hr./5 hr.		Management
Electrician	2		W151	8 hr.	S	Run Conduit through security wall
Mechanical	3		N109	1 hr.		Install Ductwork
Drywall		1	W151	8 hr.		Hang new drywall
Electrician		2	N109	2 hr.		Install Comm

Thursday, January 18, 2018 Total: 5 Day, 3 Night

Name	Day	Night	Location	Duration	*	Description
Electrician	2		W151	8 hr.		Run Conduit
Mechanical	3		N109	1 hr.		Install Ductwork
Painter		1	W151	8 hr.		New paint
Electrician		2	N109	2 hr.		Install Comm

Friday, January 19, 2018 Total: 6 Day, 4 Night

Name	Day	Night	Location	Duration	*	Description
Prime Contractor	1	1	W151, N109, W151	8 hr./5 hr.		Management
Electrician	2		W151	8 hr.		Run Conduit
Mechanical	3		N109	1 hr.	B, M	Turn off AHU M1
Painter		1	W151	8 hr.		New paint
Electrician		2	N109	2 hr.		Install Comm

Saturday, January 20, 2018 Total: 0 Day, 0 Night

Name	Day	Night	Location	Duration	*	Description

Sunday, January 21, 2018 Total: 2 Day, 0 Night

Name	Day	Night	Location	Duration	*	Description
Prime Contractor	1		W151, N109, W151	3 hr.		Management
Electrician	1		W151	3 hr.		Run Conduit

*** Coordination Categories / Special Work ***

B - Base CE **M** - Shops **F** - Fire Department **S** - Security **C** - Comm

Note: Day Sift is 0700 - 1600. Night Sift is 1600 - 2400

FOR REFERENCE ONLY

NASIC WALL PENETRATION REQUEST

19HQS23R0022_CUI_Specs-0000

PENETRATION NUMBER (S)	WALL	SIZE (IN)	FROM	TO	TYPE OF UTILITY	PROPOSED	
						DATE	TIME

LOCATION:	ABOVE CEILING

PENETRATION NUMBER (S)	PURPOSE	PENETRATION MATERIAL	WALL MATERIAL	SEAL TYPE	OPENING DURATION

CONTRACTORS		
REQUESTING	REQUIRING	PERFORMING

DESCRIPTION OF CONTRACTOR PROCEDURES AND WORK AREA PROTECTION	
PROCEDURES:	
PROTECTION:	
	ATTACH DRAWING OF LOCATION(S)

DATE SUBMITTED				APPROVALS		
SECURITY REQUIRED		GROUND REQUIRED		SECURITY	LGM	LGX
YES	NO	YES	NO			
DATES APPROVED						

REMARKS OR NOTES

ARCHITECT/ENGINEER & CONSTRUCTION SERVICES

TASK STATEMENT

SECURE FACILITY ACCESS:

A. Access within the secure facility is controlled. The CONTRACTOR (A/E design firm or Construction) shall adhere to the instructions provided below for all work on site.

RESTRICTED PERSONAL EQUIPMENT:

A. At no time will any radios, cameras, beepers, recorders, wireless PDAs, 2-way pagers and/or telephones, cellular telephones, laptops, bluetooth capable devices, flash drives or any other electronic items be permitted in the NASIC complex.

INSTRUCTIONS FOR VISITS TO WPAFB:

B. All visits to WPAFB shall be coordinated through The Base Civil Engineering Project Manager. To get on to WPAFB, the Contractor shall provide the following information to the Base Civil Engineering Project Manager and the Facility Project Manager no less than 1 week prior to the date of the requested visit.

Information Required:

- ***Date and Time of Visit and approximate time of departure***
- ***Number of People visiting***
- ***Citizenship of Each person***
- ***Full Name as it appears on the photo ID each person expects to use and a valid driver's license number.***

INSTRUCTIONS FOR SECURE FACILITY ACTIVITIES:

A. For site visits
   a. The Contractors Project Manager shall contact the **Base Contracting Office (PZ)/Corp of Engineers Office (COE)** indicating the purpose of the site visit; PZ/COE will in turn contact the LGX Project Manager or the **Facilities Maintenance Office at (937)-257-4344**, a minimum of 72 hours in advance of the site visit to arrange for the project site visit. The request will include the Name, Driver license number, and citizenship of each proposed visitor.

B. For construction
   a. The number of contract worker personnel allowable on site is dependent on the type of work and the capacity of the escorting office to support the requirement. For occupied areas inside the controlled zones of the facility, escorting will be one on one. The one on one escort requirement will limit the number of contract workers allowable to equal the number of escort personnel available. For areas turned over as construction zones or areas outside the controlled zones, escorting may be relaxed depending on the nature of the work to be done. In these cases of relaxed escorting, a maximum ratio of one escort to five (5) contract workers may be allowed. Note this number is subject to change based on the escort manager and operational security manager's investigation and assessment; in most instances actual escort to contractor ratio in a construction zone or area outside is set at one escort to three contractors.

b. The Project Manager will put together a detailed two week look-ahead schedule and each week a new updated copy of this schedule will be provided to the customer at the weekly construction coordination meeting and submitted to PZ/COE on the same day before meeting with the customer. The first date of work on any given two week look-ahead shall be no earlier than two weeks from the date it is submitted. This detailed schedule will be provided by the Contractor using the two week look ahead template provided by LGX and shall show the following:
    i. Contractor or Subcontractor name.
    ii. Brief description of the purpose of the work.
    iii. The work location(s).
    iv. The start and finish times for the work.
    v. The number of personnel scheduled to work each shift.
c. Any time work or access to areas will be needed that is not reflected on the two week look-ahead, the contractor will submit a request for special activity to PZ/COE and the government will try to best accommodate the request with minimal delay; however, the Government is not obligated and may not be able to accommodate the request for special activity with short notice (less than two weeks).
d. The facility runs continuously throughout the day; however, construction is limited to two primary time slots and will be assigned according to the project scope.
    i. Day-Shift operating hours are limited from 0730 to 1600.
        1. For primarily daytime work projects, certain activities may be required to be completed at night or on the weekends, particularly if occupant working environment is affected. Items include, but are not limited to:
            a. Painting, setting of epoxy, or other fume generating work
            b. Alarm work that would include audible or visual alarms
            c. Work in an otherwise occupied area
            d. Utility outages

    Night-Shift operating hours are limited from 1600-2400, unless the work effects one of the buildings entrance/exits, in which case the operating hours for the night shift shall be 1800-0200 with prior coordination.

    Arrangements for escorts outside of normal project hours will need to be pre-arranged well in advance of the date needed. Most requests can be accommodated if 2 weeks' notice is given, with shorter notice taken on a case-by-case basis.

GENERAL NOTES:

A. NASIC is a Controlled Entry Area. Contractor entry procedures shall be as follows:
    a. The contractor shall sign the AF Form 1109 at the sign in desk.
    b. Contractor will observe and comply with the list of prohibited items. This list includes but is not limited to phones, smart devices, fitness trackers, usb drives, laptops, and anything equipped with RFID/Wifi/Bluetooth/LTE or other forms of wireless communication. Failure to comply with this requirement could result in confiscation of the device and immediate expulsion from the facility.
    c. In the case that a prohibited device is needed for work, the contractor will provide the serial number, model number, and spec sheet for the device at least one week prior to entry for approval. If approved, the Contractor must check the device in at the desk upon arrival.
    d. The contractor shall confirm that an escort has been assigned to them and has signed for them.

e. The contractor shall be provided a white access badge. This badge must be worn by the contractor above the waist, below the shoulders and be visible at all times while in the facility. Contractors will remove and return all badges to their escort before leaving the facility.
f. The contractor shall follow security instructions of the escort at all times. Failure to follow instructions of the escort may result in the immediate expulsion of the individual from the facility.
g. The contractor shall stay in sight of the escort at all times.
h. The contractor shall not enter any room or area prior to the escort nor without the escort's permission.

B. Escorting is a requirement. All visitors and Contractors working in the complex shall anticipate daily escort coordination periods. Work day scheduling shall include up to 30 minutes at the beginning of each shift and up to 30 minutes at the end of each shift for entry and exit coordination. This time shall be included in an 8 hour work day.

C. All records, files, documents, and work papers provided by the Government or generated in support of this contract are Government property and shall be maintained and disposed of per AFMAN 37-139, Records Disposition Schedule. Any material containing drawings, layouts, room numbers, details for specialized equipment or outage dates shall be considered "For Official Use Only//FOUO", and will be marked and treated as such. See Appendix B – Document Control.

D. No foreign contractors, foreign sub-contractors, or non U.S. citizen contractor employees will be permitted access to the building, or participate in any aspect of this contract.

E. Workers will be restricted to areas described on the two week look-ahead documents within the immediate Project area, and will be escorted at all times if within the secured area. All other areas of the building are off limits. If a special need arises such that the contractor needs access to another part of the building not on the schedule, approval will be needed by the government construction manager and only if the area can be secured without major impact to the mission. Unscheduled access to areas that are not described on the two week look will be denied unless the special need is in the best interest of the Government and the request is approved by the LGM supervisor. Contractors and subcontractors should refrain from proposing any special requests to escorts without a supervisor present.

F. The contractor shall ensure all employees comply with all security requirements imposed by the Base Commander at all times while its employees are on the installation. The contractor shall also follow the instructions of each organizational commander pertaining to security.

G. In order to reduce the amount of disruptions of the general office areas, it is the responsibility of the contractor to have all necessary materials and labor available prior to entering such areas. The contractor will work each area continuously through to completion so as to minimize the need for repetitive access to and disruption of secure areas.

H. Anytime work requires the opening or penetration of a wall that is designated as a secured wall a request for special activity must be sent to PZ/COE and must subsequently be reflected on the two week look ahead. The opening will need to be completely closed by the end of that work shift and must be inspected and approved by security prior to the end of the shift in which the work is completed and prior to the contractor or subcontractor's

departure from the work area. As a result, the Contractor should plan to finish opening or penetration work with enough time left in the shift for inspection and approval by a security representative. It is noted that additional work may be required by the security representative and the contractor will not be compensated for any additional time required to correct deficient work for the closure of openings or penetrations.

I. The Government reserves the right to cancel escorts for contractors who fail to show after 30 minutes from the agreed upon meeting time. The Government is not liable for delays in recalling escorts if the contractor arrives at the agreed site after the grace period. The Contractor is encouraged to phone PZ/COE and NASIC/LGM, 937-257-4344, to minimize any delays resulting from late arrivals.

J. For the purposes of bidding the Contractor shall visit the premises to thoroughly familiarize themselves with all the details of the work and working conditions. NASIC/LG will make every effort to make the facility available for field verification of existing conditions, with proper notification by the Contractor through PZ/USACE/LGX-PM.

K. Any special need that requires the contractor to photograph a given work area will be coordinated with of NASIC/LGX at least 72-hours in advance. The contractor shall provide specific photographic requirements and objectives so that the areas may be secured for photography. NASIC/LGX will arrange for a Government photographer. The photographs will be reviewed for release and releasable photographs will be provided to the contractor in digital format.

   a. <u>At no time will the contractor be allowed to take photographs of any area of the building, neither inside nor outside the complex.</u>

L. Federal law (5 U.S.C. 6103) establishes public holidays for Federal employees. Please note that most Federal employees work on a Monday through Friday schedule. For these employees, when a holiday falls on a non-workday -- Saturday or Sunday -- the holiday usually is observed on Monday (if the holiday falls on Sunday) or Friday (if the holiday falls on Saturday).

   The Contractor must plan for certain exclusions when computing completion schedules including all Federal Holidays, Family Days, and Facility Mission Days. Contract work will not be supported on these days. The Government may agree to allow work on the subject days with a formal Contractor request and approval, but approvals will only be granted if the work effort is advantageous to the Government and can be adequately supported with an appropriate escort staff upon consideration and approval. Federal Holidays are outlined below. 9 Family Days are determined and announced each calendar year in January. The scheduled Family Days may be obtained from LG upon award of a contract. In addition to the Federal Holidays and 9 Family Days the Contractor shall also plan for 5 Facility Mission Days per year. The Facility Mission Days will be determined by the Government. NASIC Security Escorts will not be available on the Friday after Thanksgiving so Contractor work shall not be scheduled for the Friday after Thanksgiving.

2019 Holiday Schedule

Date	Holiday
Tuesday, January 1	New Year's Day
Monday, January 21	Birthday of Martin Luther King, Jr.
Monday, February 18	Washington's Birthday
Monday, May 27	Memorial Day
Thursday, July 4	Independence Day
Monday, September 2	Labor Day

Monday, October 14	Columbus Day
Monday, November 11	Veterans Day
Thursday, November 28	Thanksgiving Day
Wednesday, December 25	Christmas Day

2020 Holiday Schedule

Date	Holiday
Wednesday, January 1	New Year's Day
Monday, January 20	Birthday of Martin Luther King, Jr.
Monday, February 17	Washington's Birthday
Monday, May 25	Memorial Day
Friday, July 3*	Independence Day
Monday, September 7	Labor Day
Monday, October 12	Columbus Day
Wednesday, November 11	Veterans Day
Thursday, November 26	Thanksgiving Day
Friday, December 25	Christmas Day

*July 4, 2020 (the legal public holiday for Independence Day), falls on a Saturday. For most Federal employees, Friday, July 3, will be treated as a holiday for pay and leave purposes.

END OF DOCUMENT

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SC Fiber Task Statement

Communication Requirements

NASIC/SCXP, AUGUST 2018

COMMUNICATION REQUIREMENTS

1. The Contractor shall provide all design and installation services (as requested in project SOW) required to complete contract documents for the project in compliance with the Architect-Engineer Statement of Work and the Base Facility Standard dated March 2014.

2. Design of the project shall be in compliance with all applicable codes, regulations, Air Force manuals and as specifically indicated in the Architect-Engineer Statement of Work and the Base Facility Standard.

3. PROJECT SCOPE
   - 3.1. This Statement of Work (SOW) defines the required standards for installation of fiber optic networks at a secure government facility at Wright Patterson Air Force Base (WPAFB, OH) in support of facility renovations.
   - 3.2. Work shall be divided into two phases. The first phase is the removal of existing communications including any copper and

fiber optic cables from concentrator panel/WIC to the desk within the scope parameters of the project whether indicated on the drawings or not. It is the responsibility of the contractor to verify the required number of fibers affected. The second phase will be the reinstallation of the fiber from concentrator panel/WIC to the desk. Contractor will submit for approval a 100% set of final drawings and specifications for approval by the secure facilities communications team. Final approval by the secure facilities communications team shall be received at a minimum of 10 days prior to start of work.

3.3. Communications within this specification refers to all telecommunications requirements and is not simply limited to telephone systems. Telecommunications covers any transmission, emission, or reception of signs, signals, writings, images, and sounds, or information of any nature by wire, radio, visual, optical or other electromagnetic systems. Similarly, cabling not only applies to the cables themselves, but also includes a combination of all cables, wire, and zip-cords.

3.3.1. Installation of Communications Equipment Rooms (CER),entrance, backbone, and horizontal cabling to be in accordance with current government and industry codes and standards as referenced below.

3.3.2. Items that need special wiring and/or interface equipment must be identified in design. Specifications for special equipment to be provided by contractor. This includes items such as alarms, elevator lines, paging systems, video teleconference equipment, weatherproof telephones, intrinsically safe telephones, etc. Ref: EIA/TIA-568B.1 Section 4.1.

3.4. The Contractor shall coordinate all designs supporting communications and information system requirements with the Base Civil Engineer, the using agency, and the Base Communications Systems Officer. The Contractor shall include communications prewiring for buildings in all construction projects. Telecommunications design must be performed and stamped by a Registered Communications Distribution

Designer (RCDD) for all projects. A detailed work plan and design for all communications work to be done shall be included by at least the 65% design review.

3.5. Background; this secure government facility is a diverse multifaceted complex that has numerous ongoing projects. The design and installation of the communications is required as the projects go from start to finish. Standards are restrictive and must be followed as numerous documents dictate how, what, where, when on how fiber is to be installed, tested and certified.

4. TECHNICAL REQUIREMENTS

4.1. General

4.1.1. Installation Standards specified here are not meant to replace any Air Force Regulations, Command Regulations, Base Regulations or Industry Standards associated with the installation of fiber networks. All existing regulations must be followed. This serves to describe the specific methods this facility has adopted for installation, and Security procedures required at this government complex.

4.2. Networks within the secure facility

4.2.1. Networks at the facility are separated by operational security mode. Contractor must ensure that each network's standard is complied with, as outlined in this document.

4.2.2. All conduits shall be grounded, per TEMPEST and ICD-705 requirements.

4.2.3. Per Base Facility Standards (Chapter 10), the fiber cables shall have a maintenance loop of 1 meter at office furniture coupler box, coiled neatly and secured with a velcro, and a 1 meter loop at concentrator panel/WIC for future reconfiguration.

4.2.4. Cable tray shall be installed for main cable pathways. From cable pathway/WIC to office furniture locations, install J-Hooks to hang all fiber, coaxial/AV wire and phone cabling.

4.2.5. J-hook pathway for all network cabling shall be neat and orderly and compliant with NEC standards. Cabling shall not deflect more than 1 foot (300mm) between supports, and installed 1 foot (300mm) minimum from overhead ceiling. Maintain maximum separation between fiber optic cabling and copper cabling, they cannot be ran in the same J-hook or cable trays. If fiber does not have enough slack to raise 1 foot (300mm) above ceiling, contractor can replace fiber or splice with a fusion splice only vs. a splice connection.

4.2.6. Fiber-Optic Connectors. Contractor will meet the following insertion loss for installations:

4.2.6.1. Testing of single-mode and multi-mode fiber optic cables will follow the National Electrical Contractors Association and the Fiber Optic Association NECA/FOA 301-2009.

4.2.6.2. Optical Time Domain Reflectometer (OTDR) meters may be used to verify cable installation and splice performance. However, OTDR testing shall not be used to determine cable loss.

4.2.6.3. Multi-mode fiber will be tested at 850 and 1300nm; single-mode fiber will be tested at 1310 and 1500nm.

4.2.6.4. The calculation of the loss budget for a fiber optic link will occur during the initial design of each link. Maximum Attenuation coefficients will be per TIA-568 (dB/km) and per Annex C. of NECA/FOA 301-2009.

4.2.7. Standard Network Design for Ceiling and Under Floor Installations.

4.2.7.1. For ceiling installations, Contractor will use overhead ladder or wire cable trays to route voice and data cables.

4.2.7.1.1. The cable trays provided by the contractor shall be supported in accordance with the recommendations of the manufacturer, but at no less than 6-foot intervals. Provide 1 sq. inch (650 sq. mm) cross sectional area of the tray for each outlet location served. Cable trays shall be designed to accommodate a maximum calculated fill ratio of 60% to a maximum inside depth of 6 in (150 mm) and permit at least 40% future cable expansion within the building. A minimum of 300mm (12”) access headroom should be provided and maintained above the cable tray and other building components (e.g. air conditioning ducts, pipes, other cable trays, ceiling, etc.) and should not restrict access. Contractor must coordinate with other disciplines to insure clearances can be achieved. The cable tray shall be grounded in accordance with the provisions of Article 318, NFPA 70 and all TEMPEST requirements. Cable trays shall not pass through smoke and fire partitions. Cables that run through smoke and fire partitions shall be contained inside 4-inch fire rated pathways and are in compliance with TEMPEST Standards.

4.2.7.2. For Underfloor Installations, Contractor will use nonmetallic conduit from the cable backbone distribution system, whether cable tray or enclosed duct, to each outlet. Conduit for standard outlets must be a minimum of 1 inch (27mm) conduit and run from the outlet box to the cable tray or enclosed duct. If conduit is existing and at least 50% full new conduit shall be added and grounded if metallic per TEMPEST requirements.

4.2.8. The following identifies all connectors in use.

4.2.8.1. Network Cable and Color Code from concentrator panel/WIC to desk. Government will specify the colors of cable required for each network prior to project start. LC connectors and desk couplers from the concentrator panel/WIC to Desk will be specified in the project.

4.2.8.2. Cables will be current standards multimode fiber. 4.2.8.3. All colors (Green, Yellow, Red) will be continuous from the Concentrator Panel/WIC to the desktop/cubicle termination point/outlet.

4.2.8.3.1. Contractor to terminate each desk and printer station using LC Fiber Connectors.

4.2.8.3.2. Each desk, office or printer station should use Ortronics 6 Port SMB Part# OR-40400056 or 404TJ6 and the Color Coded LC Track Jack.

4.2.8.3.2.1. 2 Yellow Part# OR-63700039-44

4.2.8.3.2.2. 1 Red Part# OR-63700039-42

4.2.8.3.2.3. 1 Green Part# OR-63700039-45

4.2.8.3.2.4. 2 Blanks Part# OR-42100002

4.2.8.3.2.5. As requested Aqua Part# OR-63700075

4.2.8.3.3. Conference Room fiber will be terminated at the wall using Ortronics 6-Port Flush Mount Single Gang Track Jack and the Color Coded LC Track Jack.

4.2.8.3.3.1. 4 Yellow Part# OR-63700039-44

4.2.8.3.3.2. 1 Red Part# OR-63700039-42

4.2.8.3.3.3. 1 Green Part# OR-63700039-45

4.2.8.3.3.4. As requested Aqua Part# OR-63700075

4.2.8.4. Existing flush mount gang boxes/ desk couplers can be reused where possible after contractor tests connections.

4.2.8.5. All fiber currently run through wall plates with holes will have old wall plates replaced with these 6-Port gang boxes.

Contractor will install per 4.2.8.3.2 and 4.2.8.3.3 unless otherwise noted. If pre-existing installation exceeds this then match existing. Pull string to be installed in all wall mounted face plates.

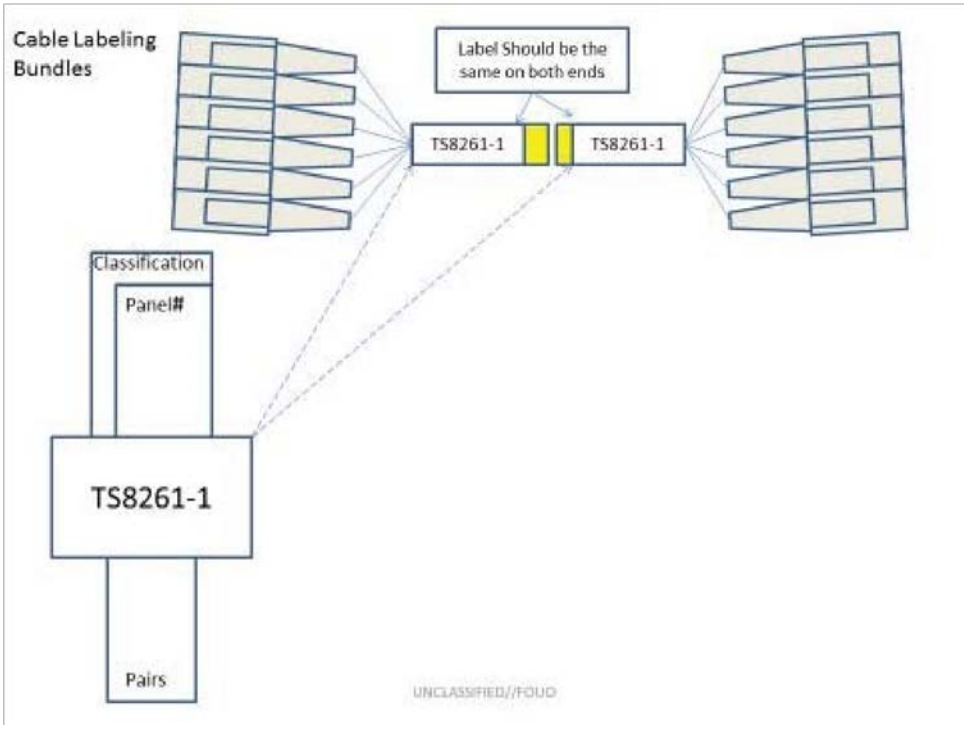
4.2.8.6. Terminate fiber optic cables at WIC panel

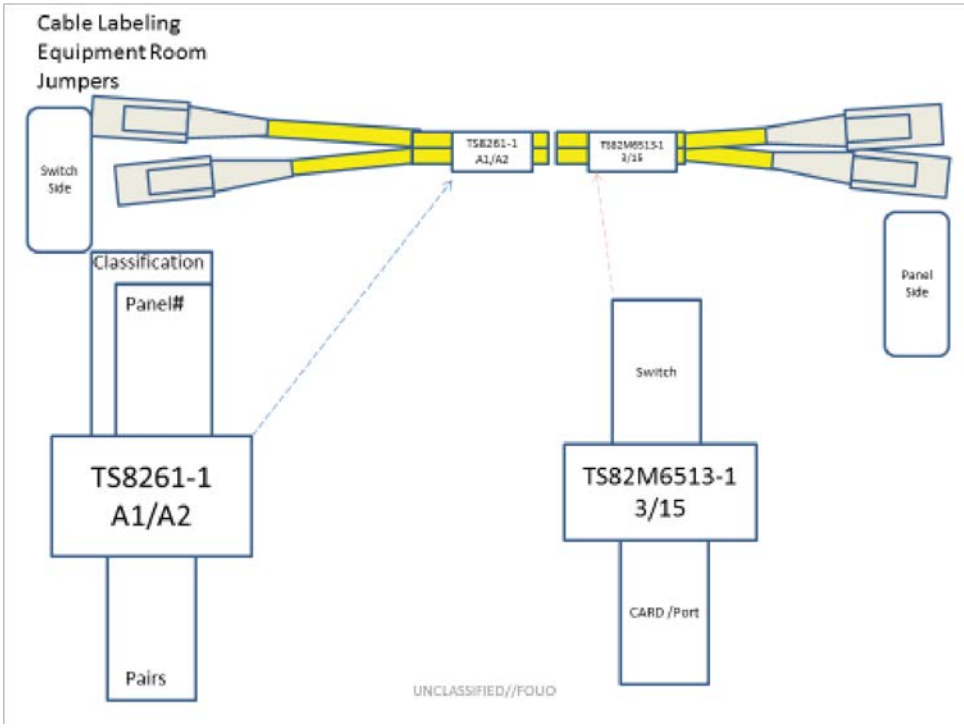
4.2.8.7. Any fiber currently installed within power poles, that does

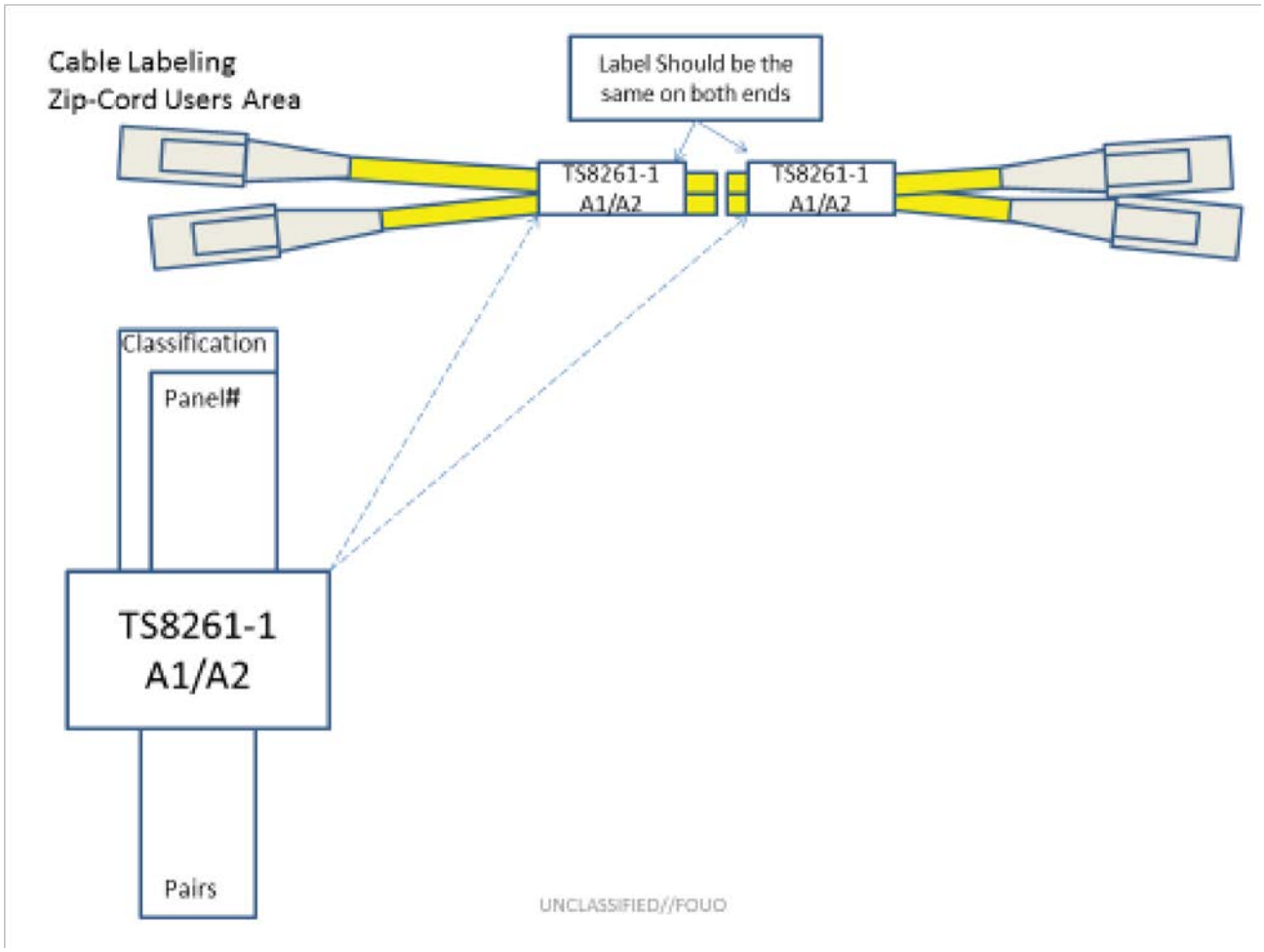
not feed systems furniture, and that has loose fiber to furniture, requires 6 Port Surface Mount Panel Part#OR400400056. Each 6 Port Surface Mount Panel will be populated with 2 Yellow, 2 Red, and 1 Green LC Fiber Connectors. Parts Used will be Yellow OR-63700039-44, Red OR-63700039-42, Green OR-63700039-45 mounted to the power pole, or the fiber is to be removed and run inside existing walls terminated into Ortronics wall mount faceplate as noted above.

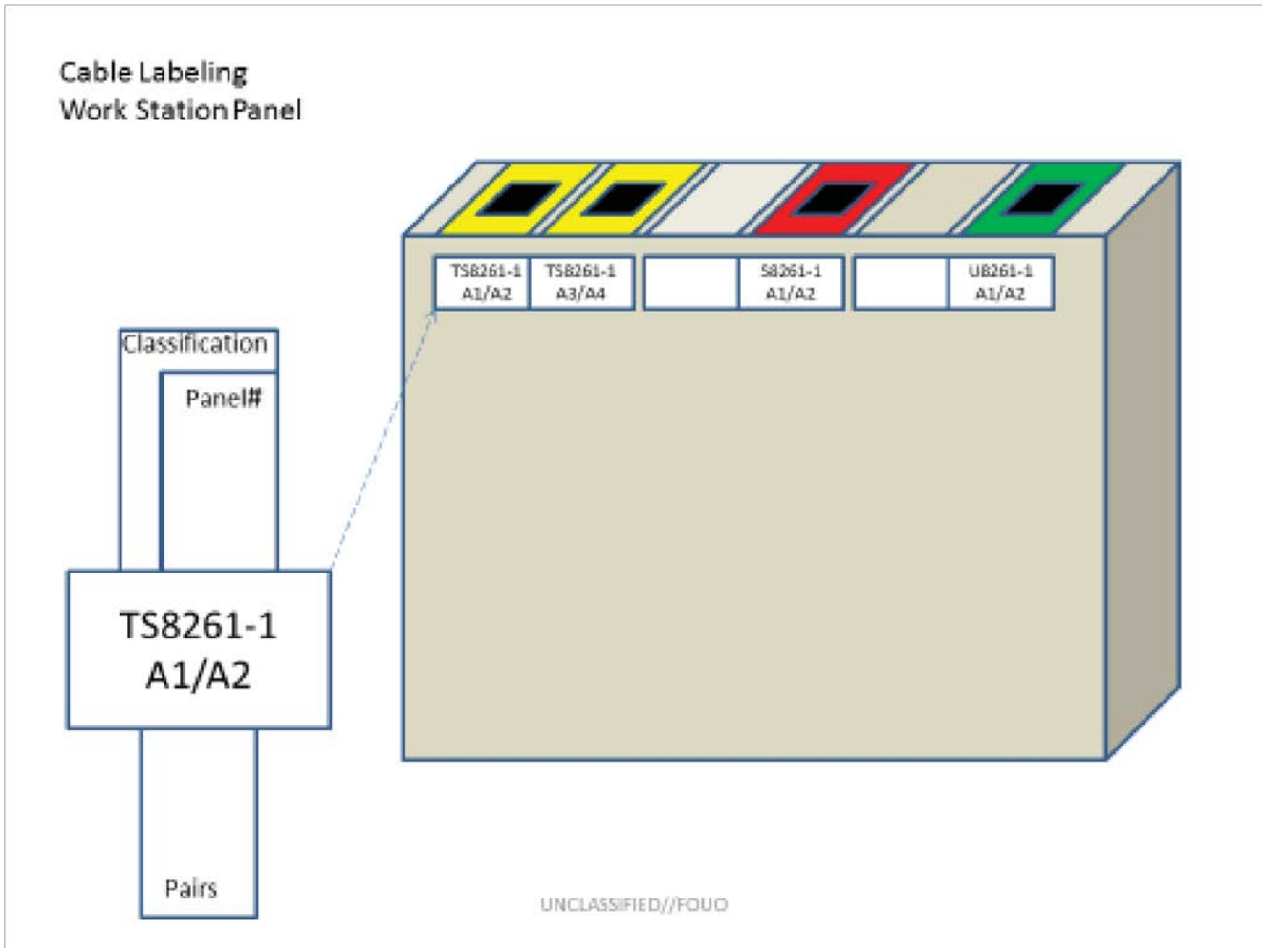
4.2.8.8. Government will provide contractor existing and new layouts of furniture, WIC panel location, and fiber locations per desk, including printer and fax locations, for reference in separate Excel spreadsheet and related drawings. Contractor is responsible for all communications within the scope parameters of the project whether indicated on the drawings or not. It is the responsibility of the contractor to verify the required number of fibers affected. Contractor will verify and document all existing cable locations and provide as built drawings of all drop locations.

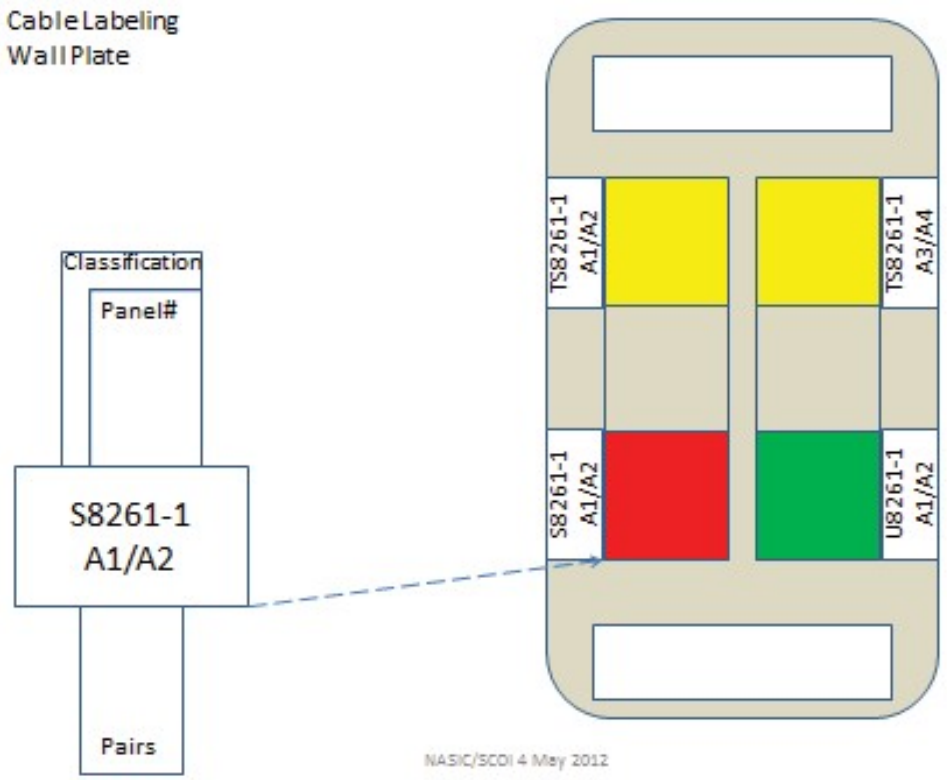
4.2.9. Labeling of Cables, equipment racks, furniture, Racks and Panels.


Cable Labeling
Bundles
Label Should be the same on both ends
TS8261-1
TS8261-1
Classification
Panel#
TS8261-1
Pairs
UNCLASSIFIED//FOUO

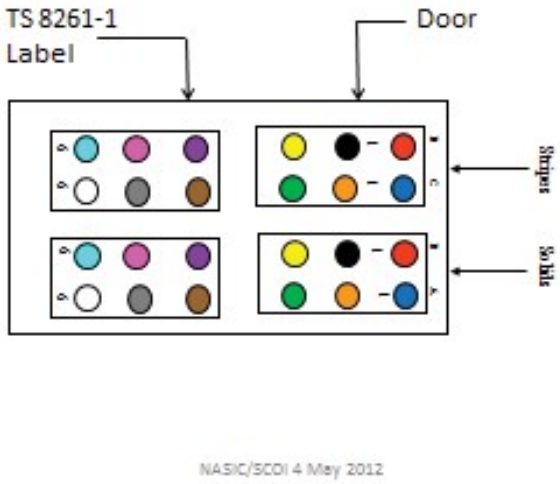

Cable Labeling
Equipment Room
Jumpers
Switch Side
TS8261-1 A1/A2
TS82M6513-1 3/15
Panel Side
Classification
Panel#
Switch
TS8261-1 A1/A2
TS82M6513-1 3/15
CARD /Port
Pairs
UNCLASSIFIED//FOUO

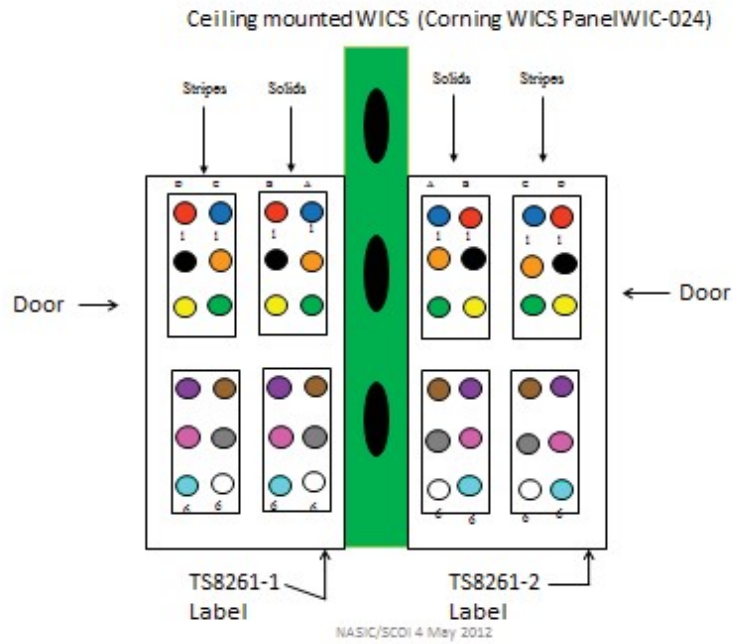

Cable Labeling
Zip-Cord Users Area
Label Should be the same on both ends
TS8261-1 A1/A2
TS8261-1 A1/A2
Classification
Panel#
TS8261-1 A1/A2
Pairs
UNCLASSIFIED//FOUO

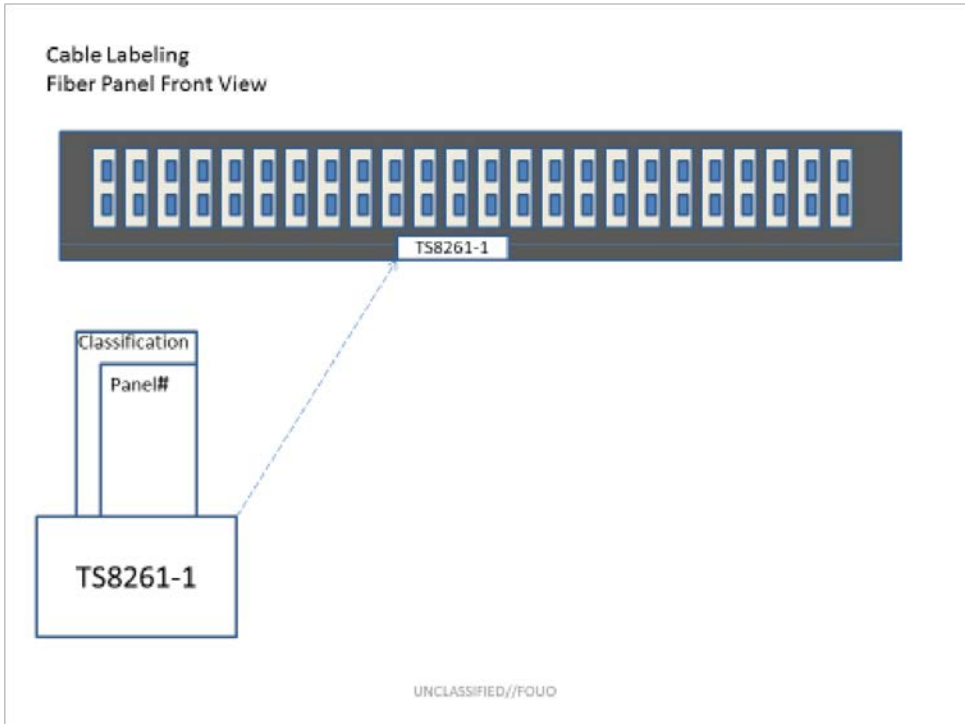

Cable Labeling
Work Station Panel
TS8261-1 A1/A2
TS8261-1 A3/A4
S8261-1 A1/A2
U8261-1 A1/A2
Classification
Panel#
TS8261-1 A1/A2
Pairs
UNCLASSIFIED//FOUO

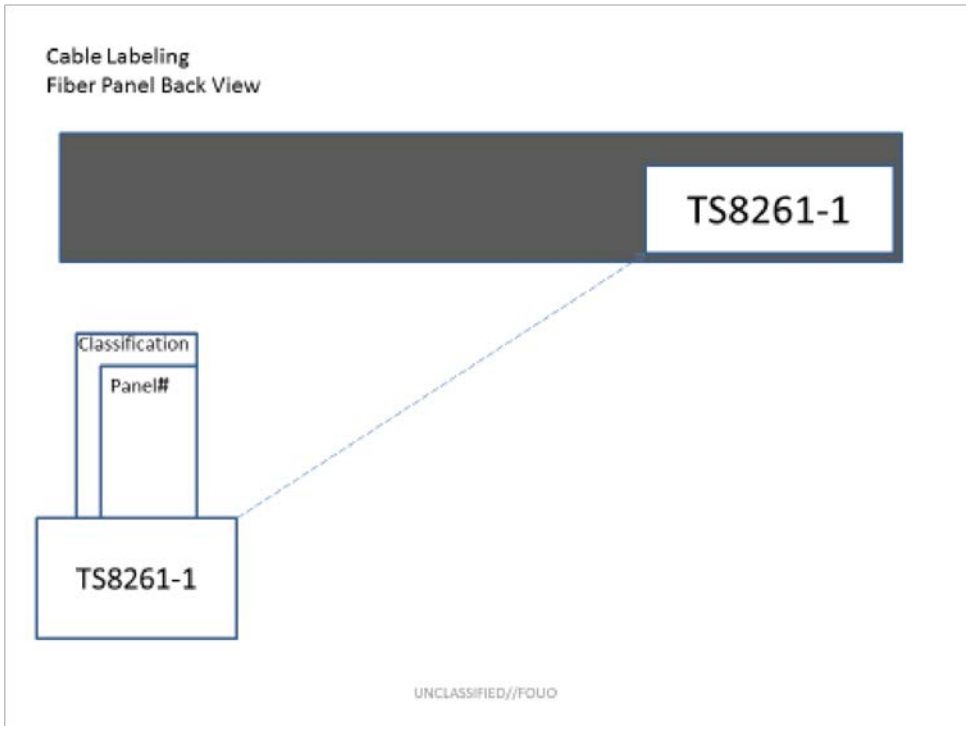


Floor Mounted WICS (Corning WICS Panel WIC-024)




Ceiling mounted WICS (Corning WICS Panel WIC-024)
Stripes
Solids
Solids
Stripes
Door
Door
TS8261-1
Label
TS8261-2
Label
NASIC/SCDI 4 May 2012


Cable Labeling
Fiber Panel Front View
TS8261-1
Classification
Panel#
TS8261-1
UNCLASSIFIED//FOUO



5. TESTING

5.1. TESTING, IDENTIFICATION AND ADMINISTRATION OF FIBER INFRASTRUCTURE GENERAL

5.1.1. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

5.1.2. In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

5.1.3. In addition to the tests detailed in this document, the contractor shall notify the Owner or the Owner's representative of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge.

5.1.4. Testing shall be performed on each cabling channel (equipment to equipment) that is identified by the owner.

5.2. TESTING SCOPE

5.2.1. This Section includes the minimum requirements for the test certification, identification and administration of backbone and horizontal optical fiber cabling.

5.2.1.1. Testing shall be carried out in accordance with this document. This includes testing the attenuation and polarity of the installed cable plant with an optical loss test set (OLTS) and the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR). The condition of the fiber end faces shall also be verified.

5.2.1.2. Testing shall be performed on each cabling link (connector to connector), after cable has been routed through furniture.

5.2.1.3. Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

5.2.1.4. All tests shall be documented including OLTS dual wavelength attenuation measurements. Documentation will include optical length measurements and pictures of the connector end face.

5.3. QUALITY ASSURANCE

5.3.1. All testing procedures and field-test instruments shall comply with applicable requirements listed in the references listed in PARA 9.

5.3.2. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

5.3.2.1. Manufacturer of the fiber optic cable and/or the fiber optic connectors.

5.3.2.2. Manufacturer of the test equipment used for the field certification or representative.

5.3.2.3. Training organization e.g. ETA-I Approved Certifications, BICSI, ARINC, Light Brigade, Air Force Training.

5.3.2.4. Installers' training certificate maintained as current and valid; number provided to Government with installer's name.

5.3.3. The Owner or the Owner's representative shall be invited to witness and/or review field-testing.

5.3.4. The Owner or the Owner's representative shall be notified of the start date of the testing phase five (5) business days before testing commences.

5.3.5. The Government or the Government representative will select a random sample of 10% of the installed links. The Government or the Government representative shall test these randomly selected links. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative, shall repeat 100% testing at no cost to the Government.

5.4. SUBMITTALS

5.4.1. Manufacturers catalog sheets and specifications for fiber optic field-test instruments including optical loss test sets (OLTS; power meter and source), optical time domain reflectometer (OTDR) and video microscope.

5.4.2. A schedule (list) of all optical fibers to be tested.

5.4.3. Sample test reports.

5.4.4. Acceptance of test results.

5.4.4.1. Unless otherwise specified by the The Government or the Government representative, each cabling link shall be in compliance with the following test limits:

5.4.4.1.1. Optical loss testing

5.4.4.1.2. Multimode and Singlemode links

5.4.4.1.3. The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568-C.0.

5.4.4.1.3.1. Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)

5.4.4.1.3.2. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

5.4.4.1.3.3. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

5.4.4.1.3.4. Maximum allowable connector_loss = 0.75 dB Check application limits, may need to reduce the allowable connector loss in this case.

5.4.4.1.3.5. Splice_Attn (dB) = number_of_splices * splice_loss (dB)

5.4.4.1.3.6. The values for the Attenuation Coefficient (dB/km) are listed in Table 1: Cable may perform better than this, check the datasheet from the vendor and insert values here if applicable.

5.5. ODTR TESTING

5.5.1. Reflective events (connections) better than -35 dB: Check application limits, may need to reduce the allowable connector loss/reflectance here.

5.5.2. 0.75 dB in optical loss when bi-directionally averaged 5.5.3.35 dB Reflectance for multimode connections.

5.5.3. -40 dB reflectance for UPC singlemode connections 5.5.5.-55 dB reflectance for APC singlemode connections.

5.5.4. Non-reflective events (splices) shall not exceed 0.3 dB.

5.5.4.1. Check test application limits, may need to reduce the allowable splice loss.

5.5.5. Magnified end face inspection

5.5.5.1. Fiber connections shall be visually inspected to IEC 61300-3-35 Edition 1.0 for end face quality.

5.5.5.2. Scratched, pitted or dirty connectors shall be diagnosed and corrected.

5.5.5.3. All installed cabling links and channels shall be fieldtested and pass the test requirements and analysis as described in Part 3. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation.

5.5.5.4. Acceptance of the test results shall be given in writing

after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Government.

5.5.6. All installed cabling links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.

5.5.7. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with

Contract Documents and to the satisfaction of the Government.

5.6. PRODUCTS

5.6.1. Optical fiber cable testers

5.6.1.1. The field-test instrument shall be within the calibration period recommended by the manufacturer and a copy of the calibration certificate made available.

5.6.2. Optical loss test set (OLTS)

5.6.2.1. Multimode optical fiber light source

5.6.2.2. Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm). VCSEL sources are not permitted per ANSI/TIA-526-14-B.

5.6.2.3. Output power of –20 dBm minimum.

5.6.2.4. The launch shall meet the Encircled Flux launch requirements of ANSI/TIA-526- 14-B.

5.6.2.5. The test reference cords must demonstrate an insertion ORVV☐G%ZKHQmated against each other.

5.6.3. Singlemode optical fiber light source

5.6.3.1. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).

5.6.3.2. Output power of –10 dBm minimum.

5.6.3.3. The test reference cords must demonstrate an insertion losV☐G%ZKHQPDWHGDJDLQVWHDFKRWKHU

5.6.4. Power meter

5.6.4.1. Provide 850 nm, 1300 nm, 1310 nm, and 1550 nm wavelength test capability.

5.6.4.2. Power measurement uncertainty of ±0.25 dB.

5.6.4.3. Store reference power measurements.

5.6.4.4. Save at least 10,000 results to internal memory.

5.6.4.5. PC interface

5.6.5. Optional length measurement

5.6.5.1. It is preferable to use an OLTS that is capable of measuring the optical length of the fiber using time-of-flight techniques. In the case of MPO/MTP trunk cables, this is not possible.

5.6.6. Optical Time Domain Reflectometer (OTDR)

5.6.6.1. Shall have a bright, color LCD display with backlight.

5.6.6.2. Shall have rechargeable battery for 8 hours of normal operation.

5.6.6.3. Internal non-volatile memory with capacity for storing at least 2,000 OTDR bi-directionally tested fiber links.

5.6.6.4. USB port to transfer data to a PC or thumb drive/memory stick. 5.6.8.Multimode OTDR

5.6.6.5. Wavelengths of 850 nm (±10 nm) and 1300 nm (+ 35 nm / - 15 nm).

5.6.6.6. Event dead zones not to exceed 0.7 m at 850 nm and 1300 nm.

5.6.6.7. Attenuation dead zones not to exceed 2.5 m at 850 nm and 4.5 m at 1300 nm.

5.6.6.8. Distance range not less than 9,000 m.

5.6.6.9. Dynamic range at least 28 dB for 850 nm and 30 dB at 1300 nm.

5.6.6.10. Allow bi-directional testing without moving the OTDR to the far end.

5.6.7. Singlemode OTDR

5.6.7.1. Wavelengths of 1310 nm (±25 nm) and 1550 nm (±30 nm).

5.6.7.2. Event dead zones not to exceed 0.6 m at 1310 nm and 1550 nm.

5.6.7.3. Attenuation dead zones not to exceed 3.7 m at 1310 nm and 1550 nm.

5.6.7.4. Distance range not less than 80 km at 1310 nm and 130 km at 1550 nm.

5.6.7.5. Dynamic range at least 32 dB for 1310 nm and 30 dB at 1550 nm.

5.6.7.6. Allow bi-directional testing without moving the OTDR to the far end.

5.6.8. Fiber Microscope

5.6.8.1. Field of view 420 µm x 320 µm

5.6.8.2. Video camera systems are preferred.

5.6.8.3. Camera probe tips that permit inspection through adapters are required.

5.6.8.4. Test equipment shall be capable of saving and reporting the end face image to IEC 613003-3-35.

5.6.9. Integrated OLTS, OTDR and fiber microscope

5.6.9.1. Test equipment that combines into one instrument an OLTS, an OTDR and a fiber microscope may be used.

5.6.10. Administration

5.6.10.1. Administration of the documentation shall include test results of each fiber link and channel.

5.6.10.2. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

5.6.10.3. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

5.7. EXECUTION

5.7.1. General

5.7.1.1. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

5.7.1.2. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

5.7.2. OPTICAL FIBER CABLE TESTING

5.7.2.1. Field-test instruments shall have the latest software and firmware installed.

5.7.2.2. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

5.7.2.3. Fiber end faces shall be inspected using a video scope with a field of view not less than 425 µm x 320 µm.

5.7.2.4. It is preferable that the end face images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.

5.7.2.5. Testing shall be performed on each cabling segment (connector to connector).

5.7.2.6. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.

5.7.2.7. Testing of the cabling shall be performed using highquality test reference cords of the same core size as the cabling under test, terminated with reference grade connectors. Reference grade connectors are defined as having a loss not exceeding 0.1 dB for multimode and 0.2 dB for singlemode. The test reference cords for OLTS testing shall be between 2 m and 5 m in length. The length of the launch and tail fibers for multimode OTDR testing shall be at a least 100 m (328 ft.). For singlemode, the length of the launch and tail fibers will depend on the link under test. As a guide, table 2 can be used for determining the length of the launch and tail fibers.

5.7.2.8. Optical loss testing

5.7.2.8.1. Horizontal/Backbone link

5.7.2.8.2. Multimode links shall be tested in one direction at 850 nm and 1300 nm in accordance with ANSI/TIA-52614-B, one-cord reference method, with an Encircled Flux compliant launch.

5.7.2.8.3. Singlemode backbone links shall be tested in one direction at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1 (One-cord reference method).

5.7.2.8.4. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

5.7.2.9. OTDR Testing

5.7.2.9.1. Fiber links shall be tested at these wavelengths for anomalies and to ensure uniformity of cable attenuation, connector insertion loss and reflectance.

5.7.2.9.2. Multimode: 850 nm and 1300 nm.

5.7.2.9.3. Singlemode: 1310 nm and 1550 nm.

5.7.2.9.4. Each fiber link and channel shall be tested in both directions.

5.7.2.9.5. The launch and tail fibers shall remain in place for the measurement in the opposite direction – failing to do so will result in an increase in measurement uncertainty.

5.7.2.9.6. The use of a loop back fiber at the far end with a tail fiber at the near end on the adjacent fiber is permitted for bi-directional testing, so long as the OTDR is able to split the trace automatically into two traces for the two fibers under test.

5.7.2.9.7. A launch cable shall be installed between the OTDR and the first link connection.

5.7.2.9.8. A tail cable shall be installed after the last link connection.

5.7.2.10. Magnified End face Inspection

5.7.2.10.1. Fibers shall be inspected using a video scope with a minimum field of view 425 µm x 320µm to IEC 61300-335 Edition 1.0. The following test limits shall be used:

5.7.2.10.1.1. Multimode connectors; Table 6 of IEC 61300-3-35 Edition 1.0

5.7.2.10.1.2. Singlemode field polished connectors; Table 5 of IEC 61300-3-35 Edition 1.0

5.7.2.10.1.3. Singlemode factory polished connectors; Table 3 of IEC 61300-3-35 Edition 1.0

5.7.2.10.1.4. Angled Physical Contact (APC) connectors; Table 4 of IEC 61300-3-35 Edition 1.0

5.7.2.11. Length Measurement

5.7.2.11.1. The length of each fiber shall be recorded.

5.7.2.11.2. It is preferable that the optical length be measured using an OLTS or OTDR.

5.7.2.12. Polarity Testing

5.7.2.12.1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

5.7.3. Identification

5.7.3.1. Labeling

5.7.3.1.1. Labeling shall conform to the requirements specified within ANSI/TIA-606-B or to the requirements specified by the Government or the Government's representative.

5.7.4. Administration

5.7.4.1. Test results documentation

5.7.4.1.1. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the fieldtest instrument". The following formats do not provide adequate protection of these records and shall not be used.

5.7.4.1.1.1. Portable document format (PDF).

5.7.4.1.1.2. Word (.doc & .docx)

5.7.4.1.1.3. Comma separated values (.csv)

5.7.4.1.1.4. Excel separated values (.xls & .xlsx)

5.7.4.1.1.5. Text (.txt)

5.7.4.1.2. The test results documentation shall be available for inspection by the Government or the Government's representative during the installation period and shall be passed to the Government or the Government's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling.

The installer shall retain a copy to aid preparation of as-built information.

5.7.4.1.3. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD/DVD prior to Government acceptance of the building in the original format used by the cabling vendors' software.

5.7.4.1.4. Circuit IDs reported by the test instrument should match the specified label ID. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information.

5.7.4.1.4.1. The identification of the customer site as specified by the end-user.

5.7.4.1.4.2. The name of the test limit selected to execute the stored test results.

5.7.4.1.4.3. The name of the personnel performing the test.

5.7.4.1.4.4. The date and time the test results were saved in the memory of the tester.

5.7.4.1.4.5. The manufacturer, model and serial number of the field-test instrument.

5.7.4.1.4.6. The version of the test software and the version of the test limit database held within the test instrument.

5.7.4.1.4.7. The fiber identification number.

5.7.4.1.4.8. The length for each optical fiber.

5.7.4.1.4.9. The index of refraction used for length calculation when using length capable OLTS.

5.7.4.1.4.10. The backscatter coefficient of the fiber under test when using an OTDR.

5.7.4.1.4.11. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).

5.7.4.1.4.12. Test results to include OTDR link and channel traces, event tables at the appropriate wavelength(s) and a map of the link tested.

5.7.4.1.4.13. The length for each optical fiber as calculated by the OTDR.

5.7.4.1.4.14. The overall Pass/Fail evaluation of the linkunder-test for OLTS and OTDR measurements

5.7.4.2. Government Optional Requirement

5.7.4.2.1. A picture or image of each fiber end-face

5.7.4.2.2. A pass/fail status of the end-face using IEC 613003-35 Edition 1.0

5.7.4.2.3. Record copy and as-built drawings

5.7.4.2.4. Provide record copy drawings periodically throughout the project as requested by the Construction Manager or Government, and at end of the project on CD/DVD. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to cable paths and termination point. CAD drawings are to incorporate test data imported from the test instruments.

5.7.4.2.4.1. The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-built shall include all field changes made up to construction completion:

5.7.4.2.4.2. Field directed changes to pull schedule.

5.7.4.2.4.3. Field directed changes to cross connect and patching schedule. 5.7.16.2.3.Horizontal cable routing changes.

5.7.4.2.4.4. Backbone cable routing or location changes.

5.7.4.2.4.5. Associated detail drawing

5.8. Installation References:

5.8.1. Base Facility Standards, WPAFB, OH Dated MAY2013

5.8.2. American National Standards Institute (ANSI) ANSI C2 National Electrical Safety Code Building Industry Consulting Services International (BICSI).

5.8.3. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA). EIA/TIA-455-30B. Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity

5.8.4. EIA/TIA-455-53A. Attenuation By Substitution Measurement For Multimode Graded-index Optical Fiber Assemblies Used In Long-Length Communications Systems.

5.8.5. EIA/TIA-492AAAA. Detail Specification for current industry standards or current infrastructure with NASIC.

5.8.6. EIA/TIA-568-C. Commercial Building Telecommunications Wiring Standard.

5.8.7. EIA/TIA-569. Commercial Building Standard For Telecommunications Pathway and Spaces. EIA/TIA-606. Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings.

5.8.8. EIA/TIA/SP-2840A(Draft). Commercial Building Telecommunications Wiring Standard. EIA/TIA TSB36. Additional Cable Specifications For Unshielded Twisted Pair Cables.

5.8.9. EIA/TIA TSB40-A. Additional Transmission Specifications For Unshielded Twisted Pair Connecting Hardware.

5.8.10. TIA-455-78B National Fire Protection Association (NFPA)

5.8.11. TIA-455-171A National Electric Code (NEC TIA-455-133A National Electric Code (NEC)

5.8.12. NECA/FOA (National Electrical Contractors Association/Fiber Optic Association) TIA-525-14-B

5.8.13. TIA-942-A (2011)

5.8.14. TIA-607-B (2011)

5.9. TESTING Standards;

5.9.1.ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources

5.9.2. ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements

5.9.3. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR

5.9.4. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant ANSI/TIA-526-14-B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement

5.9.5. TIA-TSB-4979 Practical Considerations for Implementation of Multimode Launch Conditions in the Field

5.9.6. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard

5.9.7. ANSI/TIA-606-B, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

TABLE 1

Maximum Length of Link (km)		Typical Pulse	Minimum Launch and Tail Cord Length (m)
1310 nm	1550 nm		
0 to 35	0 to 50	☐	130
35 to 45	50 to 65	3,000	400
45 to 50	65 to 75	10,000	1,000
☐	☐	20,000	2400

TABLE 2

SECTION 01 32 01.00 06

PROJECT SCHEDULE
07/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Administration -- Progress, Schedules, and Network Analysis Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with LRL Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary Project Schedule; G

Project Schedule; G

Two copies of the schedules showing codes, dates, durations, categories, etc., as required.

Project Scheduler Qualifications; G

Submit project scheduler qualifications prior to or concurrent with the Preliminary Project Schedule submission.

SD-05 Design Data

Narrative Report

Schedule Reports

Two copies of the reports showing activity numbers, descriptions, dates float, starts, finishes, durations, sequences, etc., as required.

Periodic Schedule Updates; G

Two copies of the schedules showing dates, float, starts, finishes, etc., as required.

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating (activity status) and preparation of reports. The authorized representative shall have a comprehensive knowledge of the Critical Path Method (CPM)'s scheduling principle and application. The approved representative shall have a minimum of five years' experience in scheduling projects similar in nature and complexity to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification. This person shall not be the Quality Control Manager for the contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to the FAR 52.236-15 - Schedules for Construction Contracts. Show in the schedule the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of the entire project, including the design, if applicable, and construction sequences, is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

3.1.1 Approved Project Schedule

Use the approved Project Schedule to measure the progress of the work and to aid in evaluating time extensions. Make the schedule cost loaded and activity coded. The schedule will provide the basis for all progress payments. If the Contractor fails to submit any schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

3.1.2 Schedule Status Reports

Status the schedule and provide a Schedule Status Report on at least a monthly basis. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

3.1.3 Default Terms

Failure of the Contractor to comply with the requirements of the Contracting Officer shall be grounds for a determination, by the Contracting Officer, that the Contractor is not prosecuting the work with

sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of the contract.

3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule shall be the basis for determining contract earnings during each update period and therefore the amount of each progress payment. Lack of an approved schedule update, or qualified scheduling personnel, will result in the inability of the Contracting Officer to evaluate contract earned value for the purposes of payment. Failure of the Contractor to provide all required information will result in the disapproval of the entire project schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the absence of an approved schedule, the Contracting Officer may withhold approval of requests for progress payments. In the case where project schedule revisions are directed by the Contracting Officer and those revisions have not been included in subsequent revisions or updates, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until such revisions to the Project Schedule have been made. Activity cost loading shall be reasonable, as determined by the Contracting Officer. The aggregate value of all activities coded to a contract CLIN shall equal the value of the CLIN on the Schedule.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized by the Contractor to produce and update the Project Schedule shall be capable of meeting all requirements of this specification. Failure of the Contractor to meet the requirements of this specification will result in the disapproval of the schedule. Scheduling software that meets the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11 are Primavera Enterprise products P6 release 7.0 (and subsequent versions). Files shall be saved in an .XER file format, compatible with the Government's version of the scheduling program. Conversion of data from a non-Primavera software into an .XER format will be cause for rejection of the submitted schedules. Other project software of manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. Prepare the Project Schedule using the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

Develop the Project Schedule to an appropriate level of detail. Failure to develop the Project Schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting

Officer regarding reasonable activity durations. Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

3.3.2.2 NOT USED

3.3.2.3 Procurement Activities

The schedule must include separate activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes, but is not limited to, the string of activities: submit, approve, procure, fabricate, and deliver.

3.3.2.4 Mandatory Tasks/Milestones

The following tasks must be included and listed as separate line activities. Each shall have a separate milestone for submit and a separate milestone for approval/acceptance. Furthermore, the preparation of submittals are to be separate activities from the review/approval/acceptance activities, with the government review/approval/acceptance having appropriate durations as specified in submittal procedures and properly scheduled:

	DESCRIPTION	**Spec Section paragraph**	**# days to/from relationship**
1.	**Preliminary Schedule**	01 32 01.00 06	15 calendar days
2.	**Initial Schedule (baseline)**	01 32 01.00 06	42 calendar days
3.	Required Permits	52.236-7 / 01 57 19.00 06	
	Identify each permit separately		
4.	Foundation / Substructure		Relationships/Duration TBD by KTR
	Identify multiple buildings separately		
5.	Building dry-in		
	Identify multiple buildings separately		
6.	Permanent Power		

	DESCRIPTION	Spec Section paragraph	# days to/from relationship
7.	Accident Prevention Plan	01 35 26.00 06	30 calendar days after NTP
8.	Quality Control Plan	01 45 04.10 06	30 calendar days after NTP
9.	Design Quality Control Plan		14 days after NTP
	Reference spec/paragraph if project is D/B		
10.	Air Barrier Work Plan	07 05 23	Reference the spec for more information
11.	Design Review Report (Cx Agent	01 46 00.00 06	Reference the spec for more information
12.	Sustainability Action Plan		
13.	Commissioning Plan	01 46 00.00 06	Reference the spec for more information
	Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with ECB 2005-10		
14.	Commissioning Agent	01 46 00.00 06	60 days after NTP
15.	Commissioning	01 46 00.00 06	Relationships/Duration TBD by KTR
	Identify start and finish of separate systems		
16.	Redzone Meeting	00 80 00.00 06	60 days from CRCD
17.	Fire Protection (Sprinkler System) Final Acceptance Test	21 13 13.00 10	Relationship/Duration TBD by KTR
18.	Fire Detection Fire Alarm System) Final Acceptance Test	28 31 76	Relationship/Duration TBD by KTR
19.	Building Furniture Ready	00 80 00.00 06	
20.	Prefinal Inspection	01 45 04.10 06	Relationship/Duration TBD by KTR
21.	Final Acceptance Inspection	01 45 04.10 06	Relationship/Duration TBD by KTR

	DESCRIPTION	Spec Section paragraph	# days to/from relationship
22.	Closeout Documents		30 Days prior to substantial completion.
	Separate milestone for Warranty, training, O&M manuals, as-builts, 1354, installed equipment lists, etc.)		

3.3.2.5 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals/acceptance, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.6 Activity Responsibility Coding (RESP)

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor, or government agency performing a given task. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements. Code all activities not coded with a Government Responsibility Code to the Prime Contractor or Subcontractor responsible to perform the work. Activities shall not have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE). Unacceptable code values are abbreviations of the names of subcontractors.

3.3.2.7 Activity Work Area Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew, from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities shall not have more than one Work Area Code. Not all activities are required to be Work Area coded. A lack of Work Area coding will indicate the activity is not resource or space constrained.

3.3.2.8 Contract Changes/Requests for Equitable Adjustment (REA) Coding (MODF)

Assign an Activity code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by the Contracting Officer, with a Contract Changes/REA Code. Key all Code

values to the Government's modification numbering system. Any activity or sequence of activities added to the schedule as a result of alleged constructive changes made by the Government may be added to a copy of the current schedule, subject to the approval of the Contracting Officer. Assign Activity codes for these activities with a Contract Changes/REA Code. Key the code values to the Contractor's numbering system. Approval to add these activities does not necessarily mean the Government accepts responsibility and, therefore, liability for such activities and any associated impacts to the schedule, but rather the Government recognizes such activities are appropriately added to the schedule for the purposes of maintaining a realistic and meaningful schedule. Such activities shall not be Responsibility Coded to the Government unless approved. An activity shall not have more than one Contract Changes/REA Code.

3.3.2.9 Contract Line Item (CLIN) Coding (BIDI)

Code all activities to the CLIN on the Contract Line Item Schedule to which the activity belongs. An activity shall not contain more than one CLIN Item Code. CLIN Item code all activities, even when an activity is not cost loaded.

3.3.2.10 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities based upon the phase of work in which the activity occurs. Code activities to a Construction Phase. Code fast track construction phases proposed by the Contractor to allow filtering and organizing the schedule by fast track design and construction packages. If the contract specifies construction phasing with separately defined performance periods, identify a Construction Phase Code to allow filtering and organizing the schedule accordingly. Each activity shall be identified with a single project phase and have only one Phase of Work code.

3.3.2.11 Category of Work Coding (CATW)

Assign Category of Work Code to all activities according to the category of work to which best describes the activity. Category of Work Code shall include, but is not limited to: construction submittal approvals, acceptance, procurement, fabrication, delivery, weather sensitive installation, non-weather sensitive installation, start-up, test and turnover. Assign a Category of Work Code to each activity. Each activity shall have only one Category of Work Code.

3.3.2.12 Definable Features of Work Coding (FOW1, FOW2, FOW3)

Assign a Definable Feature of Work Code to appropriate activities based on the definable feature of work to which the activity belongs. Definable Feature of Work is defined in LRL Section 01 45 04.10 06 CONTRACTOR QUALITY CONTROL. An activity shall not have more than one Definable Feature of Work Code. Not all activities are required to be Definable Feature of Work Coded.

3.3.3 Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration in the accepted contract proposal, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is acknowledged by

the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7 day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Assign the Category of Work Code - Weather Sensitive Installation to those activities that are weather sensitive. Original durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project" or NTP. The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Schedule Constraints and Open Ended Logic

Completion of the last activity in the schedule shall be constrained by the contract completion date. Schedule calculations shall result in a negative float when the calculated early finish date of the last activity is later than the contract completion date. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the contract completion date for the project, and with a zero day duration or by using the "project must finish by" date in the scheduling software. The schedule shall have no constrained dates other than those specified in the contract. The use of artificial float constraints such as "zero free float" or "zero total float" are typically prohibited. There shall only be 2 open ended activities: Start Project (or NTP) with no predecessor logic and End Project with no successor logic.

3.3.3.3 Early Project Completion

The last activity shall have a late finish constraint equal to the contract required completion date so that the schedule calculation will result in positive float if the project schedule projects a completion date prior to the contract required completion date. In the event the project schedule calculates an early completion date of the last activity prior to the contract have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The Contractor shall specifically address each of those activities in the narrative report and at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period. The Government will not approve an early completion schedule with zero float on the longest path. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall be constrained to show negative float if the calculated early finish date of the last activity in that phase is later than the specified interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work and the activity will have a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity for a project phase an activity called "End Phase X" where "X" refers to the phase of work and the activity will have a zero day duration.

3.3.4.3 Phase "X" Hammock

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" hammock activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the scheduling software. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the AS and AF dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports shall result in the disapproval of the Contractor's updated schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Disable program features which calculate one of these parameters from the other.

3.3.6 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the Contracting Officer.

3.3.7 Negative Lags and Start to Finish Relationships

Lag durations contained in the project schedule shall not have a negative value. Do not use Start to Finish (SF) relationships.

3.3.8 Calculation Mode

Schedule calculations shall retain the logic between predecessors and successors even when the successor activity starts and the predecessor activity has not finished. Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override")

will not be allowed.

3.3.9 Milestones

The schedule must include milestone activities for each significant project event including but not limited to: see list of items in paragraph 3.3.2.4 above.

Activity ID	Description	BL Start	Previous Start	Current Start	Actual Start
		BL Finish	Previous Finish	Current Finish	Actual Finish
(TBD by KTR)	Preliminary Schedule				
(TBD by KTR)	Preliminary Schedule				
(TBD by KTR)	Initial Schedule				
(TBD by KTR)					

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data CD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. When design/build requirements are not within the project scope of work, all design submittals are not applicable

3.4.1 Preliminary Project Schedule Submission

Submit the Preliminary Project Schedule, defining the Contractor's planned operations for the first 90 calendar days for approval within 15 calendar days after the NTP is acknowledged. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. Detail it for the first 90 calendar days. It may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as previously specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required Plan and Program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, the planned submissions of all early design packages, permitting activities, design review conference activities and other non-construction activities intended to occur within the first 90 calendar days. Schedule any construction activities planned for the first 90 calendar days after NTP. Constrain planned construction activities by Government acceptance of the associated design package(s)

and all other specified Program and Plan approvals. Activity code any activities that are summary in nature after the first 90 calendar days with Responsibility Code (RESP) and Feature of Work code (FOW1, FOW2, FOW3).

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer. The Contractor shall participate in a review and evaluation of the proposed schedule and analysis by the Contracting Officer.

3.4.3 Not Used

3.4.4 Periodic Schedule Updates

Based on the result of the meeting, specified in PERIODIC SCHEDULE UPDATE MEETINGS, submit periodic schedule updates. These submissions will enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.5 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website: www.rmssupport.com. The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per Day
2	RESP	4	Responsible Party (e.g. GC, subcontractor, USACE)
3	AREA	4	Area of Work
4	MODF	6	Modification or REA number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of Work
7	CATW	1	Category of Work
8	FOW1	10	Feature of Work (up to 10 characters in length)
9	FOW2	10	Feature of Work (up to 20 characters in length)
10	FOW3	10	Feature of Work (up to 30 characters in length)

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project in addition to the requirements for submission of schedules and reports in paragraphs 1.2 "SUBMITTALS":

3.5.1 XER File Submission

Provide in RMS 3.0 the project schedule in the backup format. Each submittal shall also contain all previous update backup files. Each schedule file submitted shall have a unique file name as determined by the Contractor and acceptable to the Government.

3.5.2 Narrative Report

A Narrative Report shall be provided with the Preliminary, Initial, and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis. Identify and explain why any activities that, based their calculated late dates, should have either started or finished during the update period but did not.

3.5.3 Approved Changes Verification

Only those project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Actual Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report by CLIN

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has furnished a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by CLIN item number and sort by activity number. This report shall: sum all activities coded to a particular CLIN and provide a CLIN item percent earned value; and complete and sum CLIN items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.4.5 Milestone Report

A matrix with column headings: Activity ID; Description; Baseline Start/Finish; Previous Month Start/Finish; Current Month Start/Finish; Actual Start/Finish. At a minimum, each row in the matrix shall include milestones listed in paragraph "Mandatory Tasks/Milestones".

Activity ID	Description	BL Start	Previous Start	Current Start	Actual Start
		BL Finish	Previous Finish	Current Finish	Actual Finish
TBD by KTR	Preliminary Schedule				
TBD by KTR	Initial Schedule				
TBD by KTR	_____ Permit				
	Foundation/ Substructure				
	Building Dry-in				
	Permanent Power				
	Accident Prevention Plan				
	Quality Control Plan				

Activity ID	Description	BL Start	Previous Start	Current Start	Actual Start
		BL Finish	Previous Finish	Current Finish	Actual Finish
	Design Quality Control Plan				
	Air Barrier Work Plan				
	Design Review Report (Cx Agent)				

3.5.5 Network Diagram

The network diagram is required for the Preliminary, Initial and Periodic Updates. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining earned value. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting. The meeting and resultant approvable schedule update shall be a condition precedent to a formal submission of the update as described in SUBMISSION REQUIREMENTS and to the submission of an invoice for payment. The meeting will be a working interactive exchange which will allow the Government and the Contractor the opportunity to review the updated schedule on a real time and interactive basis. The Contractor's authorized scheduling representative will organize, sort, filter and schedule the update as requested by the Government. The meeting will last no longer than 8 hours. A rough draft of the proposed activity logic corrections and narrative report shall be provided to the Government 48 hours in advance of the meeting. The Contractor's Project Manager and Authorized Scheduler shall attend the meeting with the Authorized Representative of the Contracting Officer.

3.6.1 Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule update meeting, reflecting only those changes made during the previous update meeting.

3.6.2 Status of Activities

Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting.

3.6.2.1 Start and Finish Dates

Accurately show the status of the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

3.6.2.2 Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining Durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

3.6.2.3 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government pre-final inspection activity(ies) not less than 1 percent of the total contract value, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during Government pre-final inspection(s).

3.6.2.4 Logic Changes

Specifically identify and discuss all logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, and other changes that have been made pursuant to contract provisions. The Government will only approve logic revisions for the purpose of keeping the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

3.6.2.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule that does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor believes it is entitled to an extension of the contract performance period, completion date, or any interim milestone date, furnish the following for a determination by the Contracting Officer: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of excusable delay, based on revised activity logic, duration, and costs

(updated to the specific date that the delay occurred) is a condition precedent to any approvals by the Government. In response to each Request For Proposal issued by the Government, the Contractor shall submit a schedule impact analysis demonstrating whether or not the change contemplated by the Government impacts the critical path.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.7.2 Submission Requirements

Submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Identify activities impacted in each justification for change by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

The Contracting Officer may request an interim update with revised activities for any requested time extension of over 2 weeks. Provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The Contracting Officer will approve proposed revisions to the schedule prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's

revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 WEEKLY PROGRESS MEETINGS

a. The Government and the Contractor shall meet weekly (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming three weeks. The then current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The Contractor shall provide the planned activities for the next three weeks based on a Primavera filter of the current approved schedule. Any activity that has not started or finished as planned shall be listed as a QC deficiency in RMS. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals. At the weekly progress meeting, address the status of approved schedule progress, RFIs, RFPs and Submittals. Prior to beginning work on specific work elements of a Project, the Contractor shall confer with the COR and agree on a sequence of procedures and means of access to premises and buildings; space for storage of materials and equipment; delivery of materials; and use of approaches, use of corridors, stairways, and similar means of passage. Contractor shall provide minutes for the Weekly Progress Meeting, minutes to be attached with the QC Daily Report.
b. Provide a bar chart produced by the scheduling software, organized by Total Float and Sorted by Early Start Date, and a three week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities scheduled to start during the upcoming two weeks, organized by Work Area Code (AREA) and sorted by Early Start Date.

c. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date (driving activities), are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately. Corrective action includes but is not limited to: increasing the number of work crews; increasing the number of work shifts; increasing the number of hours worked per shift; and determining if Government responsibility coded activities require Government corrective action.

3.10 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

3.11 TRANSFER OF SCHEDULE DATA INTO RMS/QCS

The Contractor shall download and upload the schedule data into the

Resident Management System (RMS) prior to RMS databases being transferred to the Government and is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and electronic export from QCS of the application for progress payment.

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SECTION 01 32 52

SPECIAL SECURITY
12/21

PART 1 GENERAL

1.1 SUMMARY

Special Security Requirements for access onto Wright-Patterson AFB (WPAFB) and for access into the secure NASIC Controlled Area are required for this project. This section identifies the minimum requirements for personnel and vehicle access.

Special security provisions for work inside a Controlled Area are required for this project. This section identifies the special provisions and restrictions for work.

1.2 DEFINITIONS

1.2.1 Construction Security Plan (CSP)

Site specific construction security procedures applicable to this project which have been coordinated with and approved by the Government Accrediting Official (AO). CSP guidance has been integrated with the procedures included herein.

1.2.2 Entry Authorization List (EAL)

The Entry Access List (EAL)is a listing of all personnel including but not limited to construction workers, visitors, deliveries etc. The EAL shall document personnel name, appropriate REAL ID act compliant identification type, company/organization name, and length of involvement.

1.2.3 Entry Control Point (ECP)

The Entry Control Point (ECP) is the point of access to the Controlled Area.

1.2.4 Site Security Manager (SSM)

The Site Security Manager (SSM) is a Government employee of NASIC responsible for overseeing and coordinating site security between the Government and Contractor.

1.2.5 Contractor Security Officer (CSO)

The Contractors Security Officer (CSO) is an employee of the prime Contractor is responsible for coordination of all security related matters with the Government.

1.2.6 Personal Electronic Devices (PED)

Personal Electronic Devices (PED) include but are not limited to cell phones, cameras, computers or other electronic devices capable of sending, receiving, transmitting, or storing data. PED are prohibited within the Controlled Area unless authorized in writing by NASIC. Refer to Section 01 11 00 ATTACHMENT A for more information.

1.2.7 Security Assistants (SA)

Security Assistants (SA) are Government employees providing escort duties within the Controlled Area and monitor compliance with respect to site security measures. SA report security related discrepancies to the Government SSM.

1.3 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor's Security Officer; G

Contractor Security Officer Assistants; G

Entry Authorization List; G

1.4 GENERAL REQUIREMENTS

The Contractor shall designate an employee to serve as the CSO who shall be responsible for all security matters for the Contractor and all subcontractors. The CSO shall have a staff of personnel adequate to manage the security duties established for this project.

1.4.1 Contractor's Security Officer Approval Requirements

The Contractor shall submit to the Contracting Officer for approval within thirty (30) days after Notice to Proceed, the name of the individual to serve as his CSO responsible for all security matters with regard to this contract. The Contractor shall not conduct any physical work on site prior to the Contracting Officer's approval of the CSO. The CSO, as a minimum, shall meet the following requirements:

a. Be a United States Citizen.

b. Be an employee of the Prime Contractor.

c. Possess a valid WPAFB access credential issued by WPAFB Security Forces – Pass and Registration.

1.4.2 Contractor Security Officer Assistants

The CSO may designate specific personnel to serve as his assistants. All Contractor security personnel shall meet the same requirements as those shown above for the CSO, including approval by the Contracting Officer. Assistants may, however, be employees of subcontractors.

1.4.3 Coordination of Security Related Matters

The CSO shall be responsible for the coordination of all security related matters with the COR and the Government's Site Security Manager (SSM). The CSO shall provide a weekly Forecast Activity Schedule augmented by daily oral update to the COR and NASIC. The Forecast Activity Schedule

shall indicate the type of work to be done, locations where work shall be performed, a summary of the materials to be received, the number of trucks to arrive and scheduled arrival times, and the identification of vendors/truck carriers.

1.5 GENERAL SECURITY PROCEDURES

1.5.1 Base Entry Requirements

The Contractor and all personnel, including all subcontractors and suppliers, shall register with WPAFB Security Forces through the COR for a base access credential. COR and/or designated Government official overseeing the contract are referred as REQUESTING OFFICIALS for a base access credential. The Contractor shall provide, on a weekly basis to the COR, a spreadsheet containing each Contractor's full name, date of birth, driver's license number and state of issue.

Contractors possessing active or retired/civilian identification are not authorized to use such identification for installation entry if the reason is for official duties or work related to this contract. Contractors are not authorized to escort other contract personnel.

Contractor personnel are required to complete WPAFB Form 1440 to request a DBIDS base access credential. Contractors will submit this form through the requesting official to WPAFB Security Forces – Pass and Registration Office Building 286. For issuance of a DBIDS credential, Contractor will undergo a background investigation including providing biometric data (fingerprints and photograph). Once properly vetted by WPAFB Security Forces, Contractors will be issued a DBIDS credential for the inclusive dates of contracted work.

For lost base access credentials; prior to re-issuance, applicants must submit a statement on company letterhead to their requesting official explaining the circumstances surrounding the lost credential. Requesting official will endorse and forward to WPAFB Security Forces – Pass and Registration along with a new properly completed WPAFB Form 1440. WPAFB Security Forces will identity proof and vet to determine eligibility for DBIDS credential re-issuance.

During the performance of the contract, the Contractor is responsible for obtaining required identification for newly assigned personnel and prompt return of credentials for any employee who no longer requires base access. Base access credentials no longer required by Contractor personnel shall be returned to the COR within 48 hours. Failure to comply with these requirements may result in withholding of final payment.

WPAFB Security Forces – Pass and Registration
WPAFB Area A, Building 286
4185 Logistics Avenue
Wright Patterson AFB, OH 45433
Hours of Operation: Monday – Friday 0700-1630 (excluding holidays)

1.5.2 Deliveries

Material and equipment deliveries shall process through WPAFB Security Forces Commercial Vehicle Delivery Gate 26A. As a standard, all vehicles 15-passenger and larger (e.g., Box truck) will process through Gate 26A. Vehicle operators should expect a minimum of 15 minutes to complete vehicle inspection for access. All others will be searched and processed

at the gate where the driver is attempting to enter WPAFB.

All construction materials, once cleared by WPAFB Security Forces, shall be delivered directly to the secure material storage location.

1.6 SECURITY PROCEDURES FOR WORK INSIDE THE SECURE FACILITY

1.6.1 Establishment of Secure Construction Zone

Contract work location is a Controlled Area consisting of the NASIC main complex including Buildings 10822, 10828, 10829, 10853, 10856, and 10858; and the attached fenced perimeter. Contractor personnel are required to abide by installation and NASIC procedures during all phases of this project.

Temporary construction facilities and secure material storage shall be coordinated with and approved by the Government. This includes approval by the WPAFB Antiterrorism Officer, or local NASIC Antiterrorism Representative. Approved location(s) are subject to change during the course of contract based on local antiterrorism guidance. The secure material storage location shall be locked at all times when unoccupied. Lock and key coding shall be coordinated with the Government.

Contractor entry into NASIC Controlled Area shall be accomplished through the West End Visitor Control Center only. Contractor personnel will in-process/out-process daily through this Visitor Control Center. Government SA will be provided to escort Contractor personnel during daily activities. At no time will Contractor personnel be provided unescorted movement throughout Controlled Area.

All persons granted access to WPAFB are subject to federal laws, and all materials, tools, containers and vehicles entering the installation and Controlled Area are subject to inspection. The CSO shall ensure all Contractor personnel under their cognizance adhere to installation and NASIC security procedures. SSM will maintain oversight of site security and may conduct random security measures for any personnel or materials within the Controlled Area.

Privately Owned Vehicles (POV) shall not enter within the Controlled Area, to include the attached fenced perimeter. Commercially marked Contractor vehicles are authorized to make material deliveries and drop off necessary equipment; however, they will be removed immediately upon completion. Procedures for commercial vehicle entry are subject to change based on local antiterrorism guidance.

1.6.2 Access to the Secure Construction Zone

1.6.2.1 Entry Authorization List (EAL)

The Contractor shall provide and maintain an EAL requiring access to the Controlled Area. The EAL shall document name, appropriate REAL ID Act compliant identification type, identification number, company/organization name, and expected length of involvement. The EAL shall be provided to the COR weekly, as a minimum, or as required to provide an update for Contractor personnel needing access to the Controlled Area. The EAL and records associated with its creation and maintenance are subject to Government review at any time.

1.6.2.2 Visitors

All visitors, including Government personnel, requiring access to the Controlled Area will be coordinated through NASIC. Regardless of affiliation (Government or Contractor), minimum eligibility requirements will be verified prior to allowing unescorted entry into the Controlled Area. Those not meeting established criteria will be escorted at all times while inside the facility.

1.6.2.3 ID Badges

All Contractor and visiting personnel shall in-process daily through the NASIC Visitor Control Center(s) to obtain the applicable color NASIC temporary access badge. Contractor personnel involved in construction and installation will in-process through the West End Visitor Control Center only. Prior to temporary access badge issuance, personnel will complete NASIC Form 1109. Temporary badges will be returned daily upon completion of scheduled activities, or when departing from the Controlled Area for scheduled breaks.

All badges are property of the US Government, and as such, must be properly protected against loss and/or theft. Lost badges will immediately be reported to the Government SSM and/or SA.

1.6.2.4 Badge Display

All personnel inside the Controlled Area shall wear their NASIC access badge at all times, displayed above the waist visible for authorized personnel to see. Contractor personnel shall also carry their WPAFB DBIDS credential, or Government issued photo identification, at all times. The CSO shall ensure all Contractor personnel are advised of installation and NASIC security procedures.

Security officials who observe violations of security procedures shall immediately notify the SSM. Any Contractor or Contractor employee who violates the site security policies will be escorted off the installation and may be denied future access. Disregard or willful non-compliance with installation and/or NASIC security procedures may be grounds for debarment from the installation in accordance with DoD 5200.8-R and USC Title 50, Sec 797.

1.6.2.5 Controlled Area Entry

All personnel requiring access to the Controlled Area will enter through a designated ECP – NASIC Visitor Control Center(s) – and sign in on NASIC Form 1109. Access eligibility will be vetted by Government personnel prior to allowing entry and provided with a cleared escort, as required. Exiting the Controlled Area will be accomplished through a designated ECP only.

1.6.3 Deliveries and Short Duration Work

Access to the Controlled Area for material delivery shall be coordinated with NASIC through the CSO. Only authorized material deliveries and pre-coordinated visits will be authorized access for drop-off. NASIC reserves the right to deny access for any delivery or short duration visit not coordinated 72 hours in advance.

1.6.4 Contraband Searches

All vehicles entering/on the installation are subject to search by the WPAFB Security Forces or other law enforcement agencies. All personnel, vehicles, and materials within or entering the Controlled Area are subject to inspection by law enforcement agencies and/or SSM, and designated representatives, for prohibited or restricted items. A combination of human, K-9, or technology may be used to conduct an inspection. Any vehicle/driver found in possession of prohibited or restricted items will be denied access and may be referred to the appropriate law enforcement agency.

1.6.5 Temporary Facilities

1.6.5.1 Contractor Temporary Facilities

Contractor temporary facilities shall not impede life-safety nor infringe upon local antiterrorism guidance. Location will be coordinated and approved by applicable Government entities prior to installation. Local antiterrorism guidance may dictate movement of Contractor temporary facilities is required during the period of performance.

1.6.6 Emergency Vehicle Access to the Site

In all emergency instances, safety of life will take precedence over security considerations. Law enforcement, fire, and rescue personnel and their vehicles will be allowed immediate and unimpeded access to the Controlled Area. The CSO will immediately report life-safety related matters to the COR and NASIC.

1.7 CONTRACTOR'S EMPLOYEE BADGING REQUIREMENTS

1.7.1 Personnel Background

a. Work shall be performed by US companies using US citizens. The CSO will confirm that each Contractor employee meets the above requirements prior to adding employee to EAL or requesting a base access credential.

b. All Contractor personnel requiring access to WPAFB and NASIC Controlled Area will undergo a background investigation which includes queries of databases including National Crime Information Center (NCIC), name check, Suspension Revocation Barment (SRB) List, and Terrorist Screening Database (TSDB). WPAFB Commander has the authority to direct queries using other Government databases, as required. These checks will be conducted by the Government at no cost to the Contractor. Refusal to submit to these background checks or failure to report adverse information may result in denial of access.

c. Historical patterns of behavior that have the potential of interfering with the security, orderly administration, and discipline of base operations are also cause for denial of access in accordance with DoD 5200.8-R.

d. WPAFB Commander, or designated representative, is the final approving authority for base access eligibility. Mitigating conditions, such as the incident being an isolated event, the incident not being recent, pressure or coercion that is no longer present, age/maturity level at the time of the incident, and evidence of rehabilitation will be

considered. Supporting documentation may be required before making a final decision to allow access.

e. The CSO will coordinate with the COR for the completion of the Contractor employee security checks. The Government will not be responsible for work delays caused by an employee failing to provide accurate and timely information.

1.7.2 Security Education, Training, and Awareness

The CSO is responsible for ensuring Contractor personnel have been trained on the site specific security procedures. The CSO will coordinate training processes and procedures with the SSM.

1.8 SPECIAL SECURITY PROVISIONS

1.8.1 Document Control

All project documentation including images and related electronic information will be protected from public release without express consent of the US Government and the SSM. Contract documents, including but not limited to, plans and specifications, shall not be stored in any manner which makes them publicly accessible via the Internet. Contractor and all subcontractors will ensure all outdated, expired, damaged, unusable, or unneeded paper and electronic media is properly disposed of. Coordinate with SSM for acceptable methods.

Both the delivery of electronic media and the documentation management, to include paper, will be coordinated by the Contractor's Security Officer.

1.8.1.1 Shred Policy

The Shred Policy applies to the management of all project related documents except those documents required to be kept for a certain time period per federal records retention requirements. The Contractor shall:

a. Shred all office paper relating to this project unless directed to return these papers to Government control. Office paper is defined as items having either printed or hand-written print on it, including but not limited to reports, briefings, sketches, drawings, meeting notes, user manuals or operating instructions.

b. Utilize cross-cut shredder to dispose of paper media. Acceptable shredders can be found on NSA Evaluated Products List. Coordinate with SSM for assistance with approved destruction methods.

c. Project related documentation shall be secured under lock-and-key when not in use.

The objective of this policy is to prevent unauthorized disclosure of CONTROLLED UNCLASSIFIED INFORMATION. This policy applies to items generated by all Contractors, businesses, and organizations working on this project.

1.8.1.2 Personal Electronic Devices

No PED are permitted inside the NASIC Controlled Area unless authorized in writing by NASIC. This prohibition includes all personal and Contractor owned electronic devices with the ability to record, transmit,

communicate, or store data such as cell phones, laptops, computers, flash drives, cameras, smartwatches, pagers, Bluetooth devices, tablets, etc. This list is not all inclusive with advancements in technology; questions regarding device prohibitions shall be referred to the SSM.

If the Contractor requires a PED in the performance of duties, requirement for entry, including device specifications, shall be requested through the NASIC Electronic Equipment approval process by the Government sponsor. Requests shall be submitted 5 business days in advance. Prohibited device capabilities will be required to disabled or the device will be denied entry. The Electronic Equipment approval letter must be attached/carried with the device at all times while in the Controlled Area.

Photography support will be coordinated with NASIC. The Contractor is not authorized to take pictures within the Controlled Area.

Unauthorized photographs/video recordings, to include the photographic devices, may be seized and subject to destruction, with no liability incurred by the US Government. Any person found in the Controlled Area in possession of an unauthorized PED, whether used to take photographs/video recording or not shall be removed from the site and denied access thereafter.

Contractor personnel shall store PED in their POV outside the Controlled Area or powered down in designated PED storage locations.

1.8.1.3 Prohibited Items and Activities

The following items and activities are prohibited on this construction site.

a. Firearms, knives, or other weapons, to include but not limited to, facsimiles of weapons, gun lighters, toy guns/weapons, baseball bats, batons, bicycle chains, blackjacks, brass knuckles, martial arts devices, ninja pins, throwing stars, or similar devices. Items normally used as a tool of the trade or in the normal course of construction such as sheet-rock knives, nail guns, etc, will be permitted but must be disclosed to the Entry Control Officers when entering the site.

b. Ammunition or other explosives: Nail guns and similar tool ammunition is allowed with notification to the ECO at the entrance. Such explosives shall be transported, stored, handled, and used in accordance with industry best practices, state or federal laws and codes, and USACE instructions (whichever is the most restrictive).

The Government reserves the right to prohibit any items, devices, or activities not covered in this list.

Any violation of the prohibitions and restrictions noted above by any Contractor personnel may, at the option of the SSM, risk forfeiture of the item(s) involved and permanent removal of the violating party from the Control Area.

1.9 SPECIAL SECURITY ESCORTS AND INSPECTIONS

NASIC will have a staff of security professionals and Government escort personnel on site during approved work hours. NASIC and staff shall not have contractual authority to direct, accept, or reject work but shall

have authority to observe the conduct of all Contractor personnel on site, to request information, and to inspect and photograph all work areas, all work in progress, and all materials brought on site, at any time, for the purpose of assessing and documenting compliance with security requirements. The Government SSM and SA shall comply with all applicable safety requirements.

1.9.1 Schedule Coordination

The Contractor shall notify the COR and NASIC as soon as practical, but no less than 72 hours in advance, of any substantial change in the nature of scheduled work or the forecasted numbers of Contractor personnel on site of any given day.

At least weekly, the NASIC shall review the expected upcoming work with the COR and Contractor, and shall identify any elements of work that must be photographed by the SSM staff prior to being covered or obscured by additional work, any operations for which the Government will need to schedule additional escorts, or any other areas of concern. The SSM shall notify the COR and Contractor as soon as practical, but no less than 24 hours in advance, of any constraint or change in circumstances affecting the ability of the SSM and staff to be present at the previously-scheduled times.

1.9.2 Access to Project Work Areas

Contractor personnel will require an escort at all times within Controlled Area. NASIC will coordinate access within the facility and notify COR/Contractor of conflicts with scheduled activities.

1.9.3 Work Inspections

The SSM will be observing and photographing all aspects of construction as it progresses. All finish work will be observed and photographed for compliance with ICD/ICS 705. All wall penetrations must be inspected and approved by the SSM prior to the close of business. If it has been determined that a portion of the work has been enclosed without inspection, the SSM may request partial demolition or removal of materials to verify that no unauthorized materials were introduced. The Contractor shall be responsible for all costs associated with demolition and any rework required.

1.10 INFORMATION SECURITY

Drawings and specifications associated with this contract are designated CONTROLLED UNCLASSIFIED INFORMATION in accordance with DoDM 5200.48, DoD Information Security Program - Controlled Unclassified Information. The Contractor shall control all project drawings and specifications, and all shop drawings or similar documents prepared in the course of work under this contract, in a manner equivalent to industry best practices for control of proprietary, financial, payroll, personnel, or similar sensitive information.

The Contractor shall not provide any information regarding the scope of this project to any news media representative. The Contractor shall refer inquiries to the WPAFB Public Affairs office. The Contractor shall not reference this project on any website or promotional material.

The Contractor shall not post, store, or distribute project documents in

any manner that is accessible to the public. The Contractor shall limit distribution and duplication of project documents to the minimum necessary for completion of work under this contract.

The default method for transferring electronic project drawings, specifications, or shop drawings between the Contractor and the Government shall be the DoD SAFE (Secure Access File Exchange) website at https://safe.apps.mil/. The DoD SAFE system allows the Government to securely transmit electronic files to any recipient, and allows any sender to securely transmit electronic files to the Government upon receipt of a "Drop-Off Request" initiated by the Government. The Contractor may use other COTS methods for secure electronic transfer with prior approval of the COR.

1.11 SECURITY INCIDENT REPORTING

A security incident is a breach, deliberate or inadvertent, of any security-related condition of this contract or applicable security policies. Any person who observes or suspects a security incident or who sees a potential risk of a future security incident shall immediately report it to a Security Assistant and/or the CSSM, and to the Contractor Security Representative and/or the COR. Any person with knowledge of the incident shall fully cooperate with the investigation to ensure prompt and accurate resolution.

Any effort to gain unauthorized access to the facilities or program information shall be immediately reported. Any suspected surveillance occurring near the construction site shall be immediately reported. All personnel are encouraged to note and report the make, model, color, and license number of any suspicious vehicle.

Personnel on the construction site should not approach any suspicious vehicle or individual. Instead, they should report their concern to the nearest Security Assistant or other security representative.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18, CHG 4: 02/21

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

1.1.2 Project Type

The Contractor's Quality Control (CQC) System Manager are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance

Surety Bonds

List Of Proposed Subcontractors

List Of Proposed Products

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan

Work Plan

Quality Control (QC) plan

Environmental Protection Plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (SDS) concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the

job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Government.

Government approval is required for any variations from the Solicitation or the Accepted Proposal and for other items as designated by the Government.

Within the terms of the Contract Clause FAR 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

1.4.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause FAR 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.5 PREPARATION

1.5.1 Transmittal Form

Use the ENG Form 4025-R transmittal form for submitting both Government-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

1.5.2 Submittal Format

1.5.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the

same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format.

1.5.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 1-1/2 inches on the right-hand side of each sheet for the Government disposition stamp.

1.5.2.3 Format of SD-03 Product Data

Present product data submittals for each section as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.2.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.2.4 Format of SD-04 Samples

1.5.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

1.5.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle

of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

1.5.2.6 Format of SD-06 Test Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

1.5.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.9 Format of SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.3 Source Drawings for Shop Drawings

1.5.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.4 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DOD SAFE Web Application located at the following website: https://safe.apps.mil/.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.6.2 Number of SD-02 Shop Drawing Copies

Submit six copies of submittals of shop drawings requiring review and approval by a QC organization. Submit seven copies of shop drawings requiring review and approval by the Contracting Officer.

1.6.3 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.6.5 Number of SD-05 Design Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of SD-06 Test Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

1.6.7 Number of SD-07 Certificate Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.8 Number of SD-08 Manufacturer's Instructions Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.9 Number of SD-09 Manufacturer's Field Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.10 Number of SD-10 Operation and Maintenance Data Copies

Submit three copies of O&M data to the Contracting Officer for review and approval.

1.6.11 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Use an electronic submittal register program furnished by the Government. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). The Government will provide the initial submittal register in electronic format.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.3 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.5 Action Codes

1.8.5.1 Contractor Action Codes

DESIGN BID BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS – The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only (FIO)	BLANK	FIO
S	Submittal is for documentation of Sustainable requirements	S	S/FIO

1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation that results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver a written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. Include the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 calendar days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required

resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 14 calendar days after the date of submission.

1.10.1 Government Reviewed Design

The Government will review design submittals for conformance with the technical requirements of the Solicitation. Government review is required for variations from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the DOR's design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required to, review extensions of design such as structural steel or reinforcement shop drawings.

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received from the QC manager.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. Three copies of the submittal will be retained by the Contracting Officer and two copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be identified and returned, as described above.

1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory. the design, general method of construction, materials, detailing, and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made unless all required DOR approvals or required Government approvals have been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information-only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.16 STAMPS

Stamps on the submittal data to certify that the submittal meets contract requirements are to be similar to the following:

CONTRACTOR (Firm Name)
_____ Approved _____ Approved with corrections as noted on submittal data and/or attached sheet(s). SIGNATURE: _____ TITLE: _____ DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 35 26.00 06

GOVERNMENT SAFETY REQUIREMENTS
04/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.32	(2013) Fall Protection
ASSP A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSP Z359.1	(2016) The Fall Protection Code

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.3	(2016) Tower Cranes
ASME B30.5	(2018) Mobile and Locomotive Cranes
ASME B30.8	(2015) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 51B	(2019) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall Protection

1.2 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP)
- Fatigue Management Plan
- Bloodborne Pathogen Plan
- Exposure Control Plan

- Hearing Conservation Program
- Respiratory Protection Plan
- Health Hazard Control Program
- Hazard Communication Program

- Asbestos Abatement Plan & Specifications

- Heat Stress Monitoring Plan
- Cold Stress Monitoring Plan
- Indoor Air Quality Management Plan
- Mold Remediation Plan

- Crystalline Silica Assessment
- Fire Prevention Plan

- Hazardous Energy Control Plan
- Standard Pre-Lift Plan (LHE)
- Critical Lift Plan - LHE

- Fall Protection and Prevention Plan
- Demolition/Renovation Plan (to include engineering survey)

- Confined Space Entry Procedures
- Confined Space Program

Activity Hazard Analysis (AHA); G, RO

Site Safety and Health Officer Qualifications(SSHO); G, RO

Proof of qualification for Crane Operators; G, RO

Critical Lift Plan; G, RO

SD-06 Test Reports

Reports

Accident Reports

Monthly Exposure Reports

Crane Reports

Regulatory Citations and Violations

SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Crane Certificate of Compliance

Submit one copy of each permit/certificate attached to each daily Quality Control Report.

1.3 DEFINITIONS

a. Site Safety and Health Officer (SSHO). The qualified or competent person who is responsible for the on-site safety and health management required for the contract project work.

b. Competent Person, Fall Protection: A person designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

c. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

d. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

e. Qualified Person, Fall Protection: A person with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, evaluating and specifying fall protection and rescue systems; shall have an advanced understanding of the regulatory requirements, physical sciences and engineering principles that affect equipment and systems for FP and rescue; be able to calculate forces generated by an arrested fall, the total loading and the deflection of the fall arrest anchorage, the impact on the structural members to which the fall arrest system is attached and shall be able to determine safe locations of anchorages; shall supervise the design, selection,

installation and inspection of certified anchorages and horizontal lifelines.

f. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

(1) Death, regardless of the time between the injury and death, or the length of the illness;

(2) Days away from work (any time lost after day of injury/illness onset);

(3) Fatal injury / illness;

(4) Permanent totally disabling injury/illness;

(5) Permanent partial disabling injury/illness;

(6) One(1) or more persons hospitalized as inpatients as a result of a single occurrence;

(7) $500,000 or greater accidental property damage;

(8) Three(3) or more individuals become ill or have a medical condition which is suspected to be related to a site condition, or a hazardous or toxic agent on the site;

(9) Restricted work;

(10) Transfer to another job;

(11) Medical treatment beyond first aid;

(12) Loss of consciousness; or

(13) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (13) above.

g. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

h. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

i. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

j. Steep roof. A roof having a slope greater than 4 in 12 (vertical to horizontal).

k. Certified Safety Professional/Certified Industrial Hygienist Qualifications

(1) Certified Construction Health & Safety Technician (CHST). An individual who is currently certified by the Board of Certified Safety Professionals.

(2) Certified Industrial Hygienist (CIH). An individual who is currently certified by the American Board of Industrial Hygiene.

(3) Certified Safety Professional (CSP). An individual who is currently certified by the Board of Certified Safety Professionals.

(4) Certified Safety Trained Supervisor (STS). An individual who is currently certified by the Board of Certified Safety Professionals.

(5) Associate Safety Professional (ASP). An individual who is currently certified by the Board of Certified Safety Professionals.

1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, federal, state, local, host nation laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.5.1 Personnel Qualifications

1.5.1.1 Site Safety and Health Officer Qualifications(SSHO)

a. A Site Safety and Health Officer (SSHO)and alternate(s) shall be provided at the work site at all times and shall be a member of the onsite work organization and be responsible for overall management of the safety and occupational health program. The SSHO shall have the authority to act in all safety matters for the Contractor at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO and alternate(s) shall be employed by the Prime Contractor and shall report to a corporate safety official or other corporate official not engaged in quality control or supervision.

The SSHO shall be:

Assigned as the SSHO and shall not be the CQC System manager or the Superintendent.

b. The SSHO and alternate(s)shall have an experience Level as follows and the Contractor must show evidence that the SSHO and alternate(s) have met these requirements. When an alternate is required for the project, the alternate shall have the same experience level and other qualifications as

the SSHO. In addition, the SSHO and alternate(s) are also required to have:

(1) Completed, as a minimum, the 30-Hour OSHA Construction Industry safety class with current First Aid and CPR Training / AED.

(2) Either a person with 10 years of demonstratable SSHO experience on similar projects or a College graduate with Five (5) years of Construction Industry safety experience on similar projects in supervising or managing general or industry construction (managing safety programs or processes or conducting hazard analyses and developing controls).

(3) Maintained experience through having taken 24 hours of EM 385-1-1 Section 21.C Competent Person Fall Protection Training and Section 22.B (8) Hours Competent Person Training for Scaffolding coursework in the past four years. The training must be applicable to the work being performed on the contract. Teaching is not considered the equivalent of attending training.

(4) SSHO shall be able to demonstrate training in the following areas: personal protective equipment and clothing to include selection, use and maintenance; hazard communication; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and, other.

c. To insure that safety and health conditions are maintained/enforced at all times, and a SSHO is present at all times, the Contractor shall designate one or more alternates to perform the safety and health requirements stated herein to cover any period when the SSHO can not be present, such as during absences for vacations/extended sickness, or when there are multiple shifts that requires additional coverage. The alternate(s) shall have the same qualifications/training/ education requirements as the SSHO.

d. The Contractor shall identify the SSHO and alternate(s)for this project and shall submit qualifications to the Government in resume form for acceptance. A copy of the letter to the SSHO and alternate(s) signed by an authorized official of the firm describing responsibilities and delegating authority to stop work when safety or occupational health of workers is compromised must be provided to the Government.

e. Acceptance of the Contractor's SSHO and alternate(s) is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during construction. The Government reserves the right to require the Contractor to make changes to operations including removal of personnel, as necessary, to obtain a safe work site. At no time will the job be permitted to operate without a SSHO on duty at the work site.

f. Duties of the SSHO shall include, as a minimum, the following in addition to the duties now listed per other paragraphs of this Section:

(1) Prepare the Contractor's Safety Plan, and Activity Hazard Analysis for each definable feature of work;

(2) Provide safety indoctrination to all construction site visitors;

(3) Ensure the Contractor's accepted Accident Prevention Plan is carried out;

(4) Ensure that all Contractor/subcontractor employees have all HTRW, asbestos, and lead paint training, and their personnel protection equipment meets applicable OSHA/EPA requirements;

(5) Conducts daily walk through of the site ensuring work is being accomplished safely and occupational health is not compromised;

(6) Attend and participate in all preparatory and initial quality control phase meetings;

(7) Conduct weekly safety meetings for all workers;

(8) Conduct monthly supervisory safety meetings;

(9) Provide accident reports;

(10) Produce a Daily Safety Report of activities performed and attach this report to the Contractor's Quality Control Report.

(11) Provide minutes for weekly and monthly safety meetings, minutes to be attached with the Daily Safety Report.

1.5.2 Personnel Duties

1.5.2.1 Site Safety and Health Officer (SSHO)

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.

b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 for prime contractor.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work safety conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

h. Other duties as identified per LRL Section 01 45 04.10 06 Contractor Quality Control. Failure to perform the above duties shall result in dismissal of the SSHO, and/or CQC System Manager, and/or superintendent and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.5.3 Meetings

1.5.3.1 Prework Safety Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the prework safety conference. The purpose of the prework safety conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's APP before the initiation of work. This includes the project superintendent, Site Safety and Health Officer, Quality Control System Manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the prework safety conference,and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

d. The functions of a prework safety conference, may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.5.3.2 Weekly Safety Meetings

Shall be conducted and documented as required by EM 385-1-1. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.5.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up control phases of quality control inspection in accordance with LRL Section 01 45 04.10 06 CONTRACTOR QUALITY CONTROL. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls; and the results reported on the daily QC Report.

1.6 TRAINING

1.6.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.6.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.6.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new control phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.7 ACCIDENT PREVENTION PLAN (APP)

a. The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed per requirements of EM 385-1-1, Appendix A-1, Paragraph 3, Signature Sheet.

Fatigue Management Plan
Bloodborne Pathogen Plan
Exposure Control Plan

Hearing Conservation Program
Respiratory Protection Plan
Health Hazard Control Program
Hazard Communication Program

Asbestos Abatement Plan & Specifications

Heat Stress Monitoring Plan
Cold Stress Monitoring Plan
Indoor Air Quality Management Plan
Mold Remediation Plan

Crystalline Silica Assessment
Fire Prevention Plan

Hazardous Energy Control Plan
Standard Pre-Lift Plan (LHE)
Critical Lift Plan - LHE

Fall Protection and Prevention Plan
Demolition/Renovation Plan (to include engineering survey)

Confined Space Entry Procedures
Confined Space Program

b. Submit the APP to the Contracting Officer fifteen (15) calendar days prior to the date of the prework safety conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

c. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Work cannot proceed without an accepted APP.

d. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and Construction Quality Control System Manager. Should any hazard become evident, stop work in the area, and secure the area. The project superintendent shall inform/notify the Contracting Officer within 12 hours of discovery, both verbally and in writing, and develop a plan for resolution as soon as possible to eliminate/ remove the hazard. In the interim, all necessary action shall be taken to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSP A10.34,) and the environment.

e. Copies of the accepted plan will be maintained at the Resident Engineer's office and at the contractor's job site office.

f. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

a. The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1 as modified by the Louisville District, using CELRL Form 1259, current edition. Submit the AHA for review at least fifteen (15) calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP.

b. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. In addition, AHA's are needed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHA's will either be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be

used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations.

c. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

d. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

e. Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

f. The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.9 DISPLAY OF SAFETY INFORMATION

Within one (1) calendar day after commencement of work, erect a safety bulletin board at the job site. The safety bulletin board shall include information and be maintained as required by EM 385-1-1, Section 01.A.07.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 REPORTS

Submit reports as their incidence occurs, in accordance with the requirements of this paragraph entitled, "Reports."

1.12.1 Accident Reports

For recordable injuries and illnesses, and property damage accidents resulting in at least $5,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within five (5) calendar day(s) of the

accident. The Contracting Officer will provide copies of any required or special forms.

1.12.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $5,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.12.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor.

1.12.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

1.12.5 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.12.6 Crane Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and USACE EM 385-1-1 Section 16. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. For cranes at DOD activities in foreign countries, the Contractor shall certify that the crane and rigging gear conform to the appropriate host country safety standards. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

1.12.7 Critical Lift Plan

Prior to performing Load Handling Equipment Critical Lifts, as identified in EM 385-1-1, a detailed Critical Lift Plan shall be developed and

written by a competent person complying with all USACE requirements in EM 385-1-1. As part of the Critical Lift Plan, Proof of qualification for Crane Operators, lift supervisors and the rigger shall be submitted to the GDA.

1.12.8 Confined Space Entry Permit

In accordance with 29 CFR 1910, 29 CFR 1915 and EM 385-1-1, prior to entering a permit required confined space, a confined space entry permit shall be completed, reviewed, processed, signed and maintained. The entry supervisor or manager shall be required to sign all permits daily before entry.

1.13 HOT WORK PERMIT

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written Hot Work Permit shall be requested from the area, base, post or local fire district. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 60 minutes after completion of the task or as specified on the hot work permit.

When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and installation/activity fire and safety regulations. The most stringent standard shall prevail.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of ten (10) working days for processing of the request for use of a hazardous material.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos,

mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within fourteen (14) calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to FAR 52.243-4 - Changes and FAR 52.236-2 - Differing Site Conditions.

3.1.4 Unanticipated Discovery of Ordnance and Explosives

If during the course of construction operations, any unanticipated or unplanned discovery of Munitions and Explosives of Concern (MEC), Explosive Media, Chemical Warfare Media (CWM), or chemical agent contaminated media (CACM) occurs, all work must cease, personnel must withdraw from the affected area and the Contracting Officer's Representative (COR) must be contacted for further information and direction. Refer ER 385-1-95 and EM 385-1-97 for additional requirements.

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least fifteen (15) days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the Installation representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE

EM 385-1-1, Section 21.C.

3.3.2 Fall Protection Equipment and Systems

The Contractor shall enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard or on a surface 6 feet or more above lower levels. Fall protection systems such as guardrails/toeboards, personnel fall arrest system, safety nets, etc., are required when working within 6 feet of any leading edge and employees shall be protected from fall hazards as specified in EM 385-1-1, Section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Section 21. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSP A10.32.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSP Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets.

(2) For work greater than (6 feet) from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a

personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.3.4 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ASSP Z359.1. Exiting horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

3.3.5 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.6 Guardrails and Safety Nets

Guardrails and safety nets shall be designed, installed and used in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

3.3.7 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan and the Accident Prevention Plan (APP).

3.4 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 (six) feet in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system/tower manufacturers shall not be used for accessing scaffold platforms greater than 6 (six) feet in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets, used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have

fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 (six) feet. Delineate fall protection requirements when working above 6 (six) feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.4.1 Stilts

The use of stilts in conjunction with scaffolds is prohibited. Stilts shall not be used for gaining additional height for construction, renovation, repair or maintenance work; see EM 385-1-1 for types of scaffolds where this requirement applies.

3.5 EQUIPMENT

3.5.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.6 Weight Handling Equipment

a. Cranes and derricks shall be equipped as specified in EM 385-1-1, Section 16.

b. The Contractor shall notify the Contracting Officer fifteen (15) days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

e. Under no circumstance shall a Contractor make a lift at or above 85% of the cranes rated capacity in any configuration.

f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 and ASME B30.5 or ASME B30.22 as applicable.

g. Crane suspended personnel work platforms (baskets) shall not be used

unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

h. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

i. All employees shall be kept clear of loads about to be lifted and of suspended loads.

j. The Contractor shall use cribbing when performing lifts on outriggers.

k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

l. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

o. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

p. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Multiple Lift Rigging (MLR aka "Christmas Tree Rigging") is not allowed unless it is for the purpose of erecting/placing structural steel ONLY.

q. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

3.7 EXCAVATIONS

The competent person shall perform soil classification in accordance with 29 CFR 1926.

3.7.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.7.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

3.7.3 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.7.4 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.8 UTILITIES WITHIN CONCRETE SLABS

Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems shall be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.9 ELECTRICAL

3.9.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When

working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

3.9.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

-- End of Section --

SECTION 01 35 43

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS (WPAFB)
12/20

PART 1 GENERAL

Attachments to this specification are as follows:

Attachment A: Hazardous Material Survey Report

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. Code (USC)

CAA Section 608	Section 608 of the Clean Air Act, Stationary Refrigeration and Air Conditioning
42 USC Chapter 85	Air Pollution Prevention and Control
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 61 Subpart M	National Emission Standard for Asbestos
40 CFR 68	Chemical Accident Prevention Provisions
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 89	Control of Emissions from Nonroad Compression-Ignition Engines
40 CFR 240.101	Solid Wastes: Definitions
40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 273	Standards for Universal Waste Management
40 CFR 745	Lead Based Paint Poisoning Prevention
40 CFR 761	Polychlorinated Biphenyls (PCBs)

40 CFR 763	Asbestos
48 CFR 52.223-1	Biobased Product Certification
48 CFR 52.223-2	Affirmative Procurement of Biobased Products Under Service and Construction Contracts
48 CFR 52.223-4	Recovered Material Certification
48 CFR 52.223-17	Affirmative Procurement of EPA-designated Items in Service and Construction Contracts

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Title III List of Lists	Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and Section 112(r) of the Clean Air Act

Ohio Administrative Code

OAC 1301:7-9	Underground Storage Tanks
OAC 3745-17	Particulate Matter Standards
OAC 3745-20	Asbestos Emission Control
OAC 3745-22	Asbestos Hazard Abatement
OAC 3745-42	Permits to Install and Plan Approvals for Water Pollution Control
OAC 3745-91	Public Water System: Plans Approval
OAC 3745-513	Authorization To Disturb Land Where a Waste Facility Was Operated

Air-Conditioning, Heating and Refrigeration Institute (AHRI)

AHRI Guideline K	(2015) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

Steel Tank Institute (STI)

STI SP001	Standard for the Inspection of Aboveground Storage Tanks
STI SP131	Standard for Inspection & Repair of Underground Steel Tanks

1.2 DEFINITIONS

1.2.1 Green Procurement.

The purchase of environmentally preferable products and services in accordance with federal requirements for recycled and biobased content.

1.2.2 Hazardous Materials (HAZMAT)

For the purposes of this document, the term HAZMAT includes all items covered under the EPCRA reporting requirement (including the Title III List of Lists), the OSHA Hazard Communication (HAZCOM) Standard, and all Class I and Class II ODSs.

1.2.3 Hazardous Wastes (HW)

Wastes which are listed by chemical name in 40 CFR 261 Subpart D, or exhibit one or more characteristics described in 40 CFR 261 Subpart C.

1.2.4 Initial Accumulation Point (IAP)

A permitted HW collection point at or near an area where HW is generated and under the control of the operator of the process that generates the waste.

1.2.5 HAZMART

The organization, function, or location which performs the HAZMAT Tracking Activity. The HAZMART is the only entity on WPAFB authorized to issue government-owned HAZMAT from any source.

1.2.6 Manifest or Uniform HW Manifest

EPA form 8700-22 and, if necessary, EPA form 8700-22A, originated and signed by the generator in accordance with the instructions included in the appendix to 40 CFR 262.

1.2.7 Safety Data Sheet (SDS)

A summary of safety, health, and emergency response information about a manufactured product obtained from the product manufacturer or distributor, and prepared in accordance with 29 CFR 1910.1200, the OSHA HAZCOM Standard. The SDS includes information about the chemical constituents, their hazards, and personal protective equipment to be used.

1.2.8 Special Waste

As defined by 40 CFR 240.101, a non-hazardous solid waste requiring handling other than that normally used for municipal solid waste.

1.2.9 Toxics and Toxic Waste

For the purposes of this section, Toxics refers to Lead Based Paint (LBP) as defined in 40 CFR 745 and Polychlorinated Biphenyls (PCBs) as defined in 40 CFR 761. Toxic Waste refers to these materials when processed for disposal.

1.2.10 Universal Waste

A subset of Hazardous Wastes, described by and managed in accordance with 40 CFR 273, including batteries, pesticides, mercury-containing thermostats or other mercury-containing devices, and fluorescent, HID, mercury vapor, low pressure sodium, and other lamps.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Coordinator Designation and Application for RCRA Training

Ohio EPA Notification of Demolition and Renovation/Abatement

Asbestos Work Plan; G

Fuel-Fired Equipment Startup Information

HAZMAT Inventory

WPAFB Worksheet 1433 - Hazardous Waste Storage Permit

SD-06 Test Reports

Asbestos Abatement Clearance Air Sampling Report

HVAC System Water Analysis; G

Quarterly Recycling and Solid Waste Summary Report

Refrigerant Record

SD-07 Certificates

Certification of Recovered and Biobased Products

Section 608 Technician Certification

Refrigerant Recovery Equipment Certification

Certificate of Conformity

STI SP001 Inspector's Training Certification

SD-11 Closeout Submittals

Green Products Determination Form (GPDF)

Notice of Termination (NOT)

1.4 GENERAL PROVISIONS

1.4.1 Base Environmental Authority

The 88th Civil Engineer Group Environmental Branch, 88 CEG/CEIE, establishes environmental compliance policy, administers environmental programs, and coordinates environment protection requirements for WPAFB. 88 CEG/CEIE consists of the Compliance Section, 88 CEG/CEIEC, and the Environmental Assets Section, 88 CEG/CEIEA. 88 CEG/CEIE is the designated environmental spokesperson for WPAFB and is the only office authorized to interface with environmental regulatory agencies.

1.4.2 Contractor's Environmental Coordinator

The Contractor shall designate a primary and alternate environmental coordinator. The environmental coordinator shall serve as the Contractor's single, integrated point of contact for all environmental questions and requirements. This individual shall be responsible for providing the Contractor's response to all environmental requirements and shall be authorized to direct the Contractor's organization to respond to environment requirements.

1.4.3 Resource Conservation and Recovery Act (RCRA) Training

Within 15 days after receipt of Notice to Proceed (NTP) submit an Environmental Coordinator Designation and Application for RCRA Training, listing the names and telephone numbers of the designated environmental coordinator and alternate. The phone numbers shall include both the usual business telephone number and a 24-hour emergency telephone number where the individual can be reached at any time for an environmental emergency. If the designated individuals have completed the WPAFB Installation RCRA Training course within the previous 12 months, indicate the date of prior completion. The RCRA Training is a one-hour course that explains local procedures and requirements for the management of HAZMATs and HW. Upon receipt of the application, 88 CEG/CEIE will contact the individuals to schedule the course.

1.4.4 Environmental Management System

The Contractor shall review the **Fundamentals of an Environmental Management System** document provided during the Preconstruction Conference following contract award, and shall sign and return the accompanying attendance form. For additional information contact 88 CEG/CEIE at 937-257-7152.

1.4.5 Permits

Unless otherwise stated, the Contractor shall obtain all necessary environmental permits and licenses and shall be responsible for payment of applicable fees. The Contractor shall comply with all terms and conditions of permits.

1.4.6 Competent Person

The Contractor shall provide a competent person on-site who is capable of identifying existing and predictable hazards in the workplace, and who has authority to take prompt corrective measures. For asbestos, a "competent person" is one who has been trained pursuant to OAC 3745-22 and 40 CFR 763, subpart E, Appendix C.

1.4.7 Maintenance of Environmental Controls

The Contractor shall identify existing and predictable sources of pollution related to work under this contract, and shall establish and maintain in good working order equipment, facilities, structures, or procedures as necessary to prevent or control any such pollution.

1.4.8 Prohibited Materials

The Contractor shall not provide nor install any asbestos containing material (ACM), nor any equipment of any kind which contains a Class I or Class II Ozone Depleting Substance (ODS). In the event that a technical specification section requires provision or installation of ACM or Class I or Class II ODS, notify the Contracting Officer's representative.

1.4.9 Recyclable Materials

Other sections within this contract may address title to or disposition of recyclable materials generated from demolition or other work under this contract. In the event of conflict between this section and others, this section shall take precedence. Refer to SOLID WASTE AND RECYCLING, below.

1.4.10 No Release of Other Requirements

Nothing in this section shall relieve the Contractor of any requirement specified in federal, state, or local laws or regulations.

1.5 GREEN PROCUREMENT

1.5.1 General

Provide materials that comply with federal requirements for recycled content and biobased content, in accordance with 40 CFR 247; the USDA BioPreferred Program; 48 CFR 52.223-17; 48 CFR 52.223-2; and the technical specification sections in this contract. Refer to https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program for assistance identifying products cited in 40 CFR 247. Refer to https://www.biopreferred.gov/BioPreferred/ for assistance identifying products in the USDA BioPreferred Program.

1.5.2 Certification of Recovered and Biobased Products

Prior to beginning work, submit in electronic PDF format Certification of Recovered and Biobased Products, as required by 48 CFR 52.223-4 and 48 CFR 52.223-1. Include the following information:

a. Project name, "ZHTV" project number, contract number, Contractor name, license number, Contractor address, Contractor signature, and date.

b. Certification as follows:

"I hereby certify the percentage of recovered materials content for EPA-designated items, and the percentage of biobased materials content for USDA-designated items, to be used in the performance of the contract will be at least the amount required by applicable specifications or other contractual requirements."

1.5.3 Green Products Determination Form (GPDF)

At least four weeks prior to the planned date of project completion, submit in electronic PDF format a Green Products Determination Form (GPDF). Include the following information:

a. Project name, "ZHTV" project number, contract number, Contractor name, license number, Contractor address, Contractor signature, and date.

b. Certification as follows:

"I hereby certify the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content, and current USDA standards for biobased materials content. The following exemptions may apply:
(1) The product does not meet appropriate performance standards;
(2) The product is not available within a reasonable time frame;
(3) The product is not available competitively (from two or more sources);
(4) The product is only available at an unreasonable price (compared with a comparable non-recycled/non-biobased content product)."

c. For each product used in the project that has a requirement or option of containing recycled content, or a requirement or option of containing biobased content, list the technical specification number, product name, total dollar value of the product, and the percentage of post-industrial recycled content, post-consumer recycled content, or percentage of biobased content. Where recycled or biobased content was required or available but not used, indicate the applicable exemption (1, 2, 3, or 4 as indicated above) and comments.

1.6 EXISTING CONDITIONS

1.6.1 Assumed Presence of Lead and Asbestos

All existing paint shall be assumed to contain lead unless proven otherwise by laboratory testing. All existing door and window caulking and glazing compounds shall be assumed to contain asbestos unless proven otherwise by laboratory testing.

1.6.2 Environmental Survey

The project area has been inspected in accordance with OAC 3745-20-02. The inspection report is attached as "Appendix A - Environmental Survey" to this section.

PART 2 PRODUCTS: NOT USED

PART 3 EXECUTION

3.1 PREVENTION OF AIR POLLUTION

3.1.1 Ohio EPA Notification of Demolition and Renovation/Abatement

This contract involves the demolition of load-supporting structural member(s) of a facility; the disturbance of at least 260 linear feet, 160 square feet, or 35 cubic feet of regulated asbestos-containing materials (ACM); or the abatement of at least 50 linear feet or 50 square feet of friable ACM.

When the contract requires demolition of load-supporting structural member(s) of a facility; the disturbance of at least 260 linear feet, 160 square feet, or 35 cubic feet of regulated ACM; or the abatement of at least 50 linear feet or 50 square feet of friable ACM, submit to the Ohio Environmental Protection Agency at least 10 days prior to planned start of work a Notification of Demolition and Renovation/Abatement with applicable fee payment. Notification forms and instructions are available at epa.ohio.gov/asbestos. Submit a copy of the completed notification form to the Contracting Officer, for forwarding to the 88 CEG/CEIE Air Quality Program Manager.

3.1.2 Asbestos Containing Material (ACM)

Existing asbestos-containing materials have been identified within the project boundaries. See Appendix A - Environmental Survey.

When asbestos-containing materials have been identified within the project boundaries, submit an Asbestos Work Plan. Include the following information:

a. Acknowledgment of the Environmental Survey appendix to this section. If the Contractor has observed discrepancies or potential discrepancies between the Environmental Survey and the conditions on the project site, include a description as applicable.

b. Site plan or facility plan drawings showing locations of regulated areas, critical barriers, containments, or decon facilities as applicable. Indicate the locations, types, quantities, and disposition (to be removed, to be encapsulated in place, to remain undisturbed, etc.) of ACM.

c. Written narrative of work procedures for abatement, containerization, manifesting, transport, disposal, and clearance air sampling and testing. Include full contact information and applicable qualifications, licensing, certification, landfill NESHAP air permit information, etc., for each involved firm or organization.

d. Names, roles/responsibilities, and training and Ohio licensing or certification documentation for all asbestos abatement personnel.

e. Expected date of notification of Demolition and Renovation/Abatement to Ohio EPA, as described above. If notification has already been completed, provide a copy in the Asbestos Work Plan and disregard requirement to submit it separately.

3.1.3 Discovery of ACM

If the Contractor encounters suspected ACM not identified in the contract documents, the Contractor shall immediately notify the Contracting Officer. Any material that is suspected of containing asbestos shall not be disturbed until the Contracting Officer has determined the content of the material and the proper handling procedures, if required. All asbestos operations shall be accomplished in accordance with this section.

3.1.4 Abatement of ACM

a. All work shall comply with 29 CFR 1926.1101, 40 CFR 61 Subpart M, OAC 3745-20, and OAC 3745-22, and shall be performed only by a

contractor licensed by the State of Ohio as an Asbestos Hazard Abatement Contractor.

b. Provide clearance air sampling in accordance with OAC 3745-22 and submit an Asbestos Abatement Clearance Air Sampling Report prior to removal of containment. Clearance air sampling shall be performed only by an Ohio-certified asbestos hazard abatement air-monitoring technician, Ohio-certified asbestos hazard evaluation specialist, or industrial hygienist certified by the American Board of Industrial Hygiene. The Report shall include written documentation of successful clearance, including the names and certifications of involved personnel and full details of the sampling and testing methodologies, the results, and applicable standards to which the results were compared.

3.1.5 Disposal of ACM

a. All disposal of ACM shall conform to OAC 3745-20-05.

b. All Regulated ACM (friable ACM or non-friable ACM that has or is likely to become friable; see 40 CFR 61.141 for full definition) shall be disposed of in an Ohio waste disposal site meeting the requirements of OAC 3745-20-06 or an out of state waste disposal site meeting the requirements of 40 CFR 61.154.

c. Coordinate waste inspection and preparation of waste shipment with the 88 CEG/CEIE Hazardous Waste Program Manager at 257-0023 or 257-5531 at least two full working days prior to scheduled transport. Provide details of the type and amount of ACM, the container type, and the contact information of the transporter and the receiving landfill. The Hazardous Waste Program Manager or designated representative will prepare the shipping manifest, inspect the load, and provide the manifest to the transporter.

d. After disposal of Regulated ACM, return the manifest signed by the landfill to the Contracting Officer for forwarding to the Hazardous Waste Program Manager within 35 calendar days of the date the waste was accepted by the transporter.

e. Non-Regulated ACM (Category I non-friable material that has not and is not expected to become friable during removal, transport, or disposal) may be disposed of in a C&D or municipal landfill. Provide a copy of all shipping papers for non-regulated waste to the Contracting Officer for forwarding to the Hazardous Waste Program Manager, within 45 days of completion of all disposal activities.

3.1.6 Particulate Matter Standards

The Contractor shall not cause or permit any fugitive dust that violates the opacity limits of OAC 3745-17 or 20% opacity as a three-minute average. Reasonably available control measures shall be used to prevent fugitive dust from becoming airborne. Such measures shall include, but not be limited to, one or more of the following:

a. Use of water or other suitable dust suppression chemicals for demolition and construction operations and the clearing of land. If water is used, it shall be reapplied at frequent intervals to keep all parts of the disturbed area at least damp at all times.

b. Use of adequate containment methods during sandblasting or other similar operations.

c. The periodic application of water or other suitable dust suppression chemicals or the use of canvas or other covering for all materials stockpiles, except temporary stockpiles on-site for 30 days or less.

d. Covering at all times of open-bodied vehicles when transporting materials likely to become airborne.

e. Prompt removal, in such a manner as to minimize re-suspension, of earth or other material from paved streets onto which earth or other materials has been deposited by trucking or earth moving equipment or erosion by water or other means.

3.1.7 Open Burning

No open burning of any construction waste or unsalvageable materials shall be permitted.

3.1.8 Contractor-Operated Fuel Tanks

If the Contractor brings a fuel tank on base for refueling of company vehicles, the Contractor shall keep a log of the fuel throughput for this tank, whether it is gasoline or diesel. The Contractor shall also notify the 88 CEG/CEIE Air Quality Program Manager (AQPM) if they are bringing such a tank on base. If more than 6,000 gallons of gasoline will be dispensed in any calendar year, the Contractor shall coordinate with the AQPM and Ohio EPA to obtain a Permit To Install for this operation. At the conclusion of the contract, the Contractor shall provide a copy of their throughput logs to 88 CEG/CEIE AQPM.

3.1.9 Stationary Combustion Engines

a. This contract does not involve provision of a stationary combustion engine or device (generator, air compressor, pump, etc) driven by a combustion engine.

b. If work involves provision of a combustion engine or engine-driven device, within 14 days of Notice To Proceed contact the 88 CEG/CEIE Air Quality PM to confirm required permits have been issued. Installation shall not occur without confirmation from 88 CEG/CEIE of applicable permit coverage.

c. The Contractor shall only install combustion engines that meet the application emissions standards and fuel requirements as outlined in 40 CFR 60, Subpart IIII (compression ignition) or Subpart JJJJ (spark ignition). With each stationary engine the Contractor shall provide the manufacturer's Certificate of Conformity (40 CFR 89) for that engine to the 88 CEG/CEIE Air Quality PM.

3.1.10 Fuel-Fired Equipment

a. This contract does not involve provision of a fuel-fired boiler, water heater, humidifier, or similar equipment.

3.2 PROTECTION OF WATER RESOURCES

3.2.1 General

a. The Contractor shall not pollute any river, stream, storm drainage structure, or body of water with chemicals, petroleum products, eroded soil, construction wastes, sewage, or other harmful materials. See also HAZARDOUS MATERIALS MANAGEMENT requirements in this specification section. All construction sites are subject to inspection by WPAFB personnel to ensure all pollution control measures are adequately installed and maintained.

b. Source Water Protection: The Contractor shall utilize best management practices to ensure proper storage, handling, use or production of regulated substances to prevent their introduction into the ground water aquifer.

3.2.2 Disturbing Less Than 1 Acre of Soil

Before any soil disturbing activity of less than 1 acre, submit an Erosion Control Plan through the contract administrator to 88 CEG/CEIE, Water Quality Program Manager (WQPM). The Erosion Control Plan shall show the Contractor's scheme for controlling erosion at the job site, including a site plan showing the area(s) to be disturbed and the placement of erosion control structures. The plan shall state the total acreage of soils to be exposed, including soil stockpiles, and shall include adequate measures to:

a. Reduce by the greatest extent practicable the area and duration of exposure of bare soils.

b. Protect readily erodible soils by use of temporary vegetation, or seeding and mulch, or by accelerating the establishment of permanent vegetation.

c. Retard the rate of runoff from construction site.

d. Trap sediment resulting from construction using silt fences, straw bale structures, other inlet protection, or sediment ponds. This includes pump discharges resulting from dewatering operations. Construction/installation details shall be included for sediment control structures.

e. Provide a schedule for inspection and maintenance of all erosion control measures including any time periods where construction operations are suspended for any reason.

3.2.3 Disturbing 1 Acre or More

a. Prepare and submit a Storm Water Pollution Prevention Plan (SWPPP) meeting the requirements of the current Ohio EPA General Permit for Storm Water Discharges from Small and Large Construction Activities. Include drawings and narratives as required to describe the construction site, potential sources of pollution in storm water discharges from the site, best management practices to control pollution, and other information as may be required by the general permit. Sign, certify, and maintain on-site the SWPPP as required by the general permit.

b. Prepare a Notice of Intent (NOI) for Coverage Under NPDES Permit using

on-line tools available at the Ohio EPA eBusiness Center website, at https://ebiz.epa.ohio.gov/. The Contractor shall be named as the applicant and shall fulfill all responsibilities of the permittee as outlined in the Ohio EPA general storm water permit for construction activities. Submit a copy of the NOI for 88 CEG/CEIE approval prior to formal submission to Ohio EPA. Following receipt of 88 CEG/CEIE approval, submit the NOI with applicable fees to Ohio EPA.

c. Within 45 days of completion of soil disturbing activity, prepare a Notice of Termination (NOT), submit to Ohio EPA, and submit a copy to 88 CEG/CEIE. This action terminates Ohio EPA permit coverage, but does not signify Government concurrence or acceptance of all contractual obligations.

3.2.4 Sanitary or Wastewater Permit to Install (PTI)

a. For any construction or modification of a sanitary sewer line (excluding the construction or modification of a lateral from an existing main to an individual facility), prepare and submit for 88 CEG/CEIE processing a PTI in accordance with OAC 3745-42. Use forms as available from the Ohio EPA website at http://www.epa.ohio.gov/dsw/pti/index.aspx. Leave "Applicant" information blank, to be completed by 88 CEG/CEIE. Provide a check in the amount of applicable fees made out to Ohio EPA, and documentation as follows:

(1) Three copies of PTI Form A and corresponding Form B.

(2) Five copies of the Project Detailed Plan.

(3) Three copies of the Project Specifications.

(4) Three copies of the Anti-degradation Permit application (if required).

b. 88 CEG/CEIE shall complete the PTI, forward to Ohio EPA, and upon Ohio EPA approval provide a record copy to the Contractor through the Contracting Officer's representative. Allow a minimum of two months for WPAFB and Ohio EPA review and approval. Delays can be minimized through preplanning and careful attention to detail in preparation of the package.

3.2.5 Drinking Water Plans Approval

a. For any construction or modification of a drinking water system, including tapping into or rerouting an existing water main, prepare and submit for 88 CEG/CEIE processing a Plans Approval package in accordance with OAC 3745-91. Use forms as available from the Ohio EPA website at http://epa.ohio.gov/ddagw/engineering.aspx. Leave "Applicant" information blank, to be completed by 88 CEG/CEIE. Provide a check in the amount of applicable fees made out to Ohio EPA, and documentation as follows:

(1) Four sets of construction drawings (certified by a P.E.)

(2) Two sets of specifications

(3) Two copies of the Ohio EPA Water Supply Data Sheet

(4) Two copies of the Project Summary Sheet

(5) Two copies of the Project Summary Letter

b. 88 CEG/CEIE shall complete the Drinking Water Plans Approval package, forward to Ohio EPA, and upon Ohio EPA approval provide a record copy to the Contractor through the Contracting Officer's representative. Allow a minimum of two months for WPAFB and Ohio EPA review and approval. Delays can be minimized through preplanning and careful attention to detail in preparation of the package.

3.2.6 HVAC System Water Analysis

This contract involves draining existing HVAC piping.

Where work involves draining existing HVAC piping, 30 days prior to start of work take a representative sample of the HVAC system water and analyze it for the total level of each of the following: Arsenic, cadmium, chromium, copper, cyanide, lead, mercury, molybdenum, nickel, phosphorus, selenium, silver, sulfide, zinc, oil and grease, chemical oxygen demand (COD), and biochemical oxygen demand (BOD). Ensure the lab performing the analyses is certified by Ohio EPA to analyze for the listed parameters. Submit the lab's HVAC System Water Analysis report. The Contracting Officer's representative, in coordination with 88 CEG/CEIE, shall review the report to determine whether the HVAC System Water can be drained directly into the sanitary sewer or must be disposed of as Hazardous Waste in accordance with this section.

When the determination allows HVAC System Water to be drained to the sanitary sewer, such work shall be considered part of this contract. When disposing of HVAC System Water as Hazardous Waste is required, the disposal shall be addressed by the Government as a new requirement beyond the terms of the original contract.

3.3 PROTECTION OF LAND RESOURCES

3.3.1 Preserve Existing Resources

The Contractor shall confine all activities to areas designated by the contract drawings and specifications. Prior to beginning any exterior construction work the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, drill, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms.

3.3.2 Restore Damaged Resources

All disturbed soil areas that previously supported vegetation, regardless of the type of vegetation, shall be restored. If the area is to be seeded, it shall consist of perennial species (not annual) and the work shall be started and completed either in March through mid-May or in September through mid-October. If seeding cannot be accomplished during these times, a mulch or temporary cover crop such as rye shall be placed on the disturbed area to prevent erosion in the interim.

3.3.3 Landfill, Earthfill, or Waste Burial Sites

This contract does not involve site work within 300 feet of a boundary of

a Landfill, Earthfill, or Waste Burial site. Where the contract documents indicate the boundary of a Landfill, Earthfill, or Waste Burial Site, and where grading, filling, excavation, drilling, or similar earthwork is required within 300 feet of such a site, submit an Application for Authorization - Environmental Restoration Site Disturbance in accordance with OAC 3745-513-400 at least 60 days prior to the proposed start of work. Contact the AFCEC/CZOM Installation Restoration Program office at 937-257-2201 for details.

3.4 CONTROL OF PCB COMPOUNDS

a. All work involving the handling of PCBs shall be performed in strict conformance to the applicable requirements of 40 CFR 761.

b. Any PCB waste generated as part of a renovation or demolition shall be managed in accordance with 40 CFR 761 Sub-Part D. Process all PCB shipment manifests through 88 CEG/CEIEC.

c. Fluorescent Light Ballasts (FLB). FLBs shall be visually inspected IAW 40 CFR 761 to determine if they are PCB-containing FLBs prior to removal for disposal. Work involving the removal and disposal of PCB containing FLBs shall be conducted in accordance with 40 CFR 761.60 (b)(2)(i) and (iv). Note: Disposal in accordance with 40 CFR 761.60 (ii) is not authorized for PCB FLBs from WPAFB.

3.5 SOLID WASTE AND RECYCLING

3.5.1 Waste Collection and Disposal

a. Litter shall be controlled and containerized at all times. Care shall be exercised to ensure no litter is lost from any vehicle while in transit to or from the construction site.

b. Manage all wastes in strict conformance with applicable laws and regulations. Dispose of all waste materials generated by this work outside the limits of WPAFB, except as noted below.

3.5.2 Recyclable Materials

The Contractor shall participate in the Qualified Recycling Program (QRP) for recyclable wastes generated on the installation. Collect recyclable materials from the work site and deliver them to the Wright-Patterson AFB Recycling Center. Minimize the amount of non-recyclables mixed into any delivery to the Recycling Center.

a. Recycle metals including steel, cast iron, piping, fittings, conduit, communication wire, electrical wire, brass, copper, aluminum, lead plates or shielding, and non-PCB fluorescent light ballasts. Cut metal into pieces which fit in a 30-yard container. Metals of different types may be comingled in a single container.

b. Recycle clean cardboard and paper products. Deliver cardboard and paper products separately, each in their own container.

c. Other materials may be recyclable if they can be cost-effectively segregated from demolition debris. Confirm the recyclability of other materials with 88 CEG/CEIE through the Contracting Officer's representative.

d. Provide the general contractor name, "ZHTV" project number, contract number, and building number to the 88 CEG/CEIE Recycling Program Manager at the time of or before the first recycling drop-off. All trucks carrying recyclables shall be weighed in at Building 293 in Area A on the recycling center scales full and then empty. If recycling center scales are inoperable, the Contractor shall use Defense Logistics Agency (DLA) scales located at Building 741 in Area B. The Contractor will get a weight ticket so that the weights of recyclables can be included by the Contractor on their quarterly diversion report. The recycling center is open M-F 0700 to 1530 and closed on holidays and some other predetermined worker training days. Call 937-257-4889 to ensure the recycling center is open for business.

3.5.3 Waste Diversion

a. Minimize solid waste generation, maximize pollution prevention processes, and maximize landfill diversion efforts through source reduction, reuse of materials, and recycling. Divert at least 60% of construction and demolition waste coming from the construction site. In cases where 60% is infeasible, provide written explanation as to why this amount could not be diverted.

b. Track solid waste generation and disposal, and submit a Quarterly Recycling and Solid Waste Summary Report (WPAFB Diversion Report) no later than the 10th day of each January, April, July, and October, covering the preceding three months. The Government will provide a copy of the report form during the Preconstruction Conference following contract award. Include the following:

(1) Tonnage of construction and demolition materials recycled, and associated cost to recycle

(2) Tonnage of construction and demolition materials reused, and associated cost to reuse

(3) Tonnage of construction and demolition materials mulched, and associated cost to mulch

(4) Tonnage of construction and demolition materials converted from waste to energy, and associated cost to convert from waste to energy

(5) Tonnage of construction and demolition materials disposed of at a landfill, and associated cost to landfill

(6) Tonnage of construction and demolition materials incinerated, and associated cost to incinerate

(7) Narrative explanation if overall diversion rate is less than 60%

3.6 HAZARDOUS MATERIALS MANAGEMENT

3.6.1 General

The Contractor shall minimize the risk of spills of any hazardous material, and in the event of a spill shall contain, report, and clean up the spill and restore any damaged area. Use, handle, and store all HAZMATs in accordance with applicable state and federal laws. Follow manufacturer's recommendations for control of temperature, humidity, cleanliness, and material handling relative to storage and use of all

HAZMATS. Furnish chemical security cabinets, gas cylinder storage cages, locks, secondary containment, spill response equipment, fire extinguishers, personal protective equipment, or other items as appropriate to safely and securely manage HAZMATs at the project site. Ensure site personnel are familiar with safe handling and emergency response procedures for hazardous materials. Upon completion of work, remove all HAZMAT.

3.6.2 HAZMAT Inventory and Site Specific Spill Plan

a. Prior to bringing solvents, adhesives, paints, fuels, oils, chemicals, or other HAZMAT onto WPAFB, submit a HAZMAT Inventory listing each proposed type of hazardous material, along with the container size (volume) and the expected quantity of each size of container applicable to each material. Submit a Site Specific Spill Plan (SSSP) detailing routine management and emergency response procedures for each material. The Government will provide a copy of the SSSP format during the Preconstruction Conference following contract award; for additional information contact 88 CEG/CEIE at 937-257-5899.

b. If proposed volumes exceed threshold quantities defined in 40 CFR 68, notify 88 CEG/CEIE at 937-257-5899 at least 30 working days prior to bringing the materials on-site. Provide other information as may be requested by 88 CEG/CEIE to support installation risk management planning in accordance with the Clean Air Act Section 112(r).

c. Update the HAZMAT Inventory and SSSP as necessary if additional materials are added over the course of work, and post the updated inventory and SSSP at the material storage location(s). An SDS for each HAZMAT brought onto WPAFB shall be readily available at the project site or in the possession of the user prior to the HAZMAT being used.

3.6.3 Labeling

Individually label each HAZMAT container with a durable adhesive label or tag, printed electronically or filled out legibly with a pen capable of withstanding diverse climate/weather conditions. If paper labels are used, provide lamination or similar protection to prevent deterioration. Promptly replace labels which become lost, worn, faded, of defaced in any manner. If a HAZMAT container is too small for placement of the label, the item can be stored in a plastic bag with the label attached or affixed to the container by other means as long as the label stays with the product. Labels shall provide the following information:

a. Contractor's company name and address

b. Contractor's point of contact name and phone number

c. "ZHTV" project number and contract number

3.6.4 Spill Response

a. If a spill occurs beyond the Contractor's ability to immediately and safely contain, notify the Fire Department by calling 937-257-9111 or by calling 911 and asking the dispatcher to transfer you to the WPAFB Emergency Communications Center. Also notify the Contracting Officer's representative.

b. In addition to emergency notifications as described above, notify the Fire Department and the Contracting Officer's representative of any spill of more than one gallon of fuel or oil; any quantity of hazardous chemicals; or any quantity of any hazardous material in a sewer, drain, storm drainage structure, or other area with the potential to pollute the environment.

c. Following any spill resulting from the Contractor's actions or inactions, the Contractor shall clean up spilled material and restore the area as determined by the Contracting Officer in coordination with 88 CEG/CEIE.

3.6.5 Ozone Depleting Substances (ODS)

a. This contract does not involve removal of or work on equipment containing ODS.

b. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants. Recovery of ODS shall comply with CAA Section 608; 42 USC Chapter 85, Air Pollution Prevention and Control; and 40 CFR 82, Protection of Stratospheric Ozone.

c. Technicians shall be certified in accordance with CAA Section 608 and 40 CFR 82.161. Submit Section 608 Technician Certification prior to commencing work.

d. Recovery equipment shall be certified by an EPA-approved testing organization in accordance with 40 CFR 82.158. Submit Refrigerant Recovery Equipment Certification prior to commencing work.

e. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type of ODS, filled to no more than 80 percent capacity, and provide appropriate labeling.

f. All recovered Class I ODS and all recovered R-22/HCFC-22 refrigerant shall remain the property of the Government. Turn properly filled and labeled cylinders over to the Government as directed by the Contracting Officer in coordination with 88 CEG/CEIE. If the contract involves work on existing equipment to remain, put recovered ODS back into the existing equipment.

g. Recovered Class II ODS in a quantity of 20 pounds or more shall remain the property of the Government. Turn properly filled and labeled cylinders over to the Government as directed by the Contracting Officer in coordination with 88 CEG/CEIE. If the contract involves work on existing equipment to remain, put recovered ODS back into the existing equipment.

h. Recovered Class II ODS in a quantity less than 20 pounds, and other refrigerants not described above, shall be removed unless put back into existing equipment to remain in accordance with contract requirements.

i. Submit a Refrigerant Record within one working day of completion of work involving refrigerants. List the facility number, the type of refrigeration equipment, the type of refrigerant, the process affecting refrigerant (installation, recharging, removal, etc), the quantity or quantities added, recovered, or lost (as applicable), and

the disposition (put back into the equipment, turned over to the Government, removed by the Contractor, or lost).

3.7 HAZARDOUS WASTE MANAGEMENT

3.7.1 Hazardous, Toxic, or Special Waste Disposal

The Contractor shall manage in accordance with applicable laws and this section any wastes which cannot be disposed of in a "RCRA Subtitle D" Municipal Solid Waste or Construction & Demolition Debris Landfill.

a. Asbestos waste shall be handled in accordance with "Disposal of Asbestos Containing Materials (ACM)" in this section.

b. PCB waste shall be disposed of in an EPA-approved waste disposal site meeting the requirements of 40 CFR 761.60.

c. All other hazardous wastes including Lead Based Paint debris shall be managed as specified below.

d. For non-hazardous Special Wastes, or for any waste for which the Contractor is uncertain of proper disposal requirements, notify the Contracting Officer and 88 CEG/CEIE.

3.7.2 Initial Accumulation Point (IAP)

The Contractor shall establish an IAP if any hazardous or other regulated wastes are to be stored on WPAFB for greater than 24 hours. The Contractor shall schedule an IAP site visit with an 88 CEG/CEIE representative prior to waste storage by calling 937-257-0023 or 257-5531, and requesting inspection of the proposed IAP storage area. For each IAP, the Contractor shall apply in writing through the contract administrator to 88 CEG/CEIE for a WPAFB Worksheet 1433 - Hazardous Waste Storage Permit. The permit shall include the proposed IAP location, description of the regulated waste, estimated quantity of waste to be generated, and the type(s) of waste containers to be stored. The Contractor shall manage the IAP in accordance with the WPAFB HW Management Plan and shall furnish all containers, labels, locks, security, chemical storage cabinets, secondary containment, spill response equipment, fire extinguishers, personnel protective equipment, and other materials as may be necessary. A maximum of 55 gallons of HW or one quart of acutely HW may be stored in an IAP at any one time. The Contractor's environmental coordinator and alternate shall serve as the primary and alternate managers for each IAP. The IAP manager shall properly complete and maintain all required documentation associated with the IAP including, but not limited to, container labeling, SDSs, waste profile sheets, container tracking logs, weekly inspection logs, SSSPs, and RCRA training certificates (see "Resource Conservation and Recovery Act (RCRA) Training" in this section).

3.7.3 HW Container Storage and Labeling

Store and label HW containers in accordance with applicable laws and as specified below. These requirements address the labeling and security of all items containing HW including drums, bottles, boxes, cans, barrels, bags, and miscellaneous containers. The Contractor shall maintain a running inventory of material, waste, and empty containers.

3.7.3.1 Identification Labeling

Individually label each container with a durable adhesive label or tag, printed electronically or filled out legibly with a pen capable of withstanding diverse climate/weather conditions. If paper labels are used, provide lamination or similar protection to prevent deterioration. Promptly replace labels which become lost, worn, faded, of defaced in any manner. If a hazardous waste container is too small for placement of the label, the item can be stored in a plastic bag with the label attached or affixed to the container by other means as long as the label stays with the product. Labels shall provide the following information:

a. Contractor's company name and address

b. Contractor's point of contact name and phone number

c. "ZHTV" project number and contract number

3.7.3.2 Content Labeling

Individually label each container in accordance with 40 CFR 262.32. All containers shall have one of the following acceptable labels properly filled out and in good condition:

a. NON-REGULATED WASTE (Blue label - NON-RCRA but DOT regulated, i.e., sodium hydroxide solid)

b. NON HAZARDOUS WASTE (Green Label - NON-RCRA / NON-DOT)

c. HAZARDOUS WASTE

d. EMPTY

e. UNIVERSAL WASTE

3.7.3.3 Storage

All containers shall be secured so that they are under control of the Contractor and to prevent access to unauthorized personnel. Containers shall be stored indoors or in an area not accessible by the general base population. If more than 12 empty containers are stored in a single area, they shall be clearly sectioned off and identified as empty.

3.7.3.4 Discovery of unknown materials

If containers of unknown constituents are found, notify 88 CEG/CEIE immediately and mark the unknown container(s) with the following information:

a. Name and phone number of container owner, if known

b. Date 88 CEG/CEIE was notified

3.7.4 HW Disposal and Turn-In

3.7.4.1 Hazardous Waste

The Government will dispose of properly containerized and labeled hazardous waste generated by the Contractor in the course of work under

this contract. Contact 88 CEG/CEIE at 937-257-0023 or 257-5531 prior to accumulation of more than 55 gallons of HW or more than 1 quart of acutely HW, and again as necessary prior to completion of work, to arrange pickup. Send the following information via email to the CEIE HW Program Manager, with a copy to the Contracting Officer's representative:

a. Primary or alternate IAP manager's name and phone number

b. Name of Contractor

c. Facility number (5-digit number) where waste was generated

d. Common or generic name of waste

e. Constituent chemicals and, if known, their percentages in the waste

f. EPA waste codes IAW 40 CFR 261

g. Description of process generating waste

h. Container type (i.e. metal drum, cardboard box, glass bottle, etc)

i. Container size (volume of container, not volume of the waste)

j. Number of containers requiring pick-up

k. Physical state (solid / liquid / gas / sludge)

l. pH of material

m. Flashpoint of material

n. Copy of SDS or sample results

3.7.4.2 Waste Petroleum Products

If an existing infrastructure component contains a petroleum product, and removal or alteration of the component results in the petroleum product becoming a waste to be disposed of, coordinate applicable disposal requirements with the 88 CEG/CEIE HW Program Manager and the Contracting Officer's representative.

3.7.5 HW Recycling

Any HW that is being offered for recycling (e.g., batteries, solvent waste being sent for recycling, wipes being sent for laundering) may be handled outside of the normal HW disposal channels. The Contractor shall obtain approval in writing from the Contracting Officer's representative in coordination with 88 CEG/CEIE prior to commencing any such operations. All recycled HW shall be accompanied with a manifest signed by 88 CEG/CEIE prior to removal from WPAFB.

3.8 ABOVEGROUND AND UNDERGROUND STORAGE TANKS

a. This contract does not involve provision or alteration of aboveground storage tanks (AST) or underground storage tanks (UST).

b. For work involving AST or UST, provide a STI SP001 certified inspector to inspect the completed work. Submit along with STI SP001

Inspector's Training Certification upon completion of related work. The report shall include the project "ZHTV" number, contract number, facility number if applicable, tank dataplate information, a legible close-up photograph of each dataplate, and an overall photograph showing the location and immediate surroundings of each completed tank. For AST, include details documenting each completed tank's compliance with contract requirements and applicable STI standards. For UST, include details documenting each completed tank's compliance with contract requirements and applicable OAC 1301:7-9 and STI SP131 standards. Include a signed memorandum from the Quality Control Manager, certifying the tank and installation meet all contract requirements and have been accurately recorded on As-Built Drawings.

c. All tanks shall be constructed of material that is compatible with the product to be stored.

d. All secondary containment areas for tank and piping systems shall be constructed of material compatible with the product to be stored. Containment areas shall also be impervious and capable of holding product and preventing contamination of soil and water in the event of a spill or release.

e. All tanks shall be labeled as to product stored and associated hazards. All labeling shall meet applicable regulatory requirements.

f. For ASTs, containment shall be provided by either external secondary containment of sufficient capacity to hold at least 110% of the total volume of the tank system or, alternatively, the tank shall have a double-wall with interstitial monitoring capability. The exception to this requirement is for ASTs holding extremely hazardous substances, such as sulfuric acid. Tanks intended to store HAZMATs, such as sulfuric acid, shall have a double-wall and external secondary containment. Containment for piping shall be either double-wall or installation of appropriate containment or diversionary structures or equipment to prevent a release from reaching surface water before cleanup can occur.

g. Temporary storage tanks brought onto base shall also have acceptable, impervious secondary containment or a double wall for the tank system, including piping. Temporary tanks shall be properly labeled as to product stored and hazards and inspected regularly and the inspection documented. Accumulated storm water in secondary containment areas shall be inspected for the presence of product stored prior to discharge and the inspection documented. Any amount of product present in secondary containment areas shall be removed promptly and prior to discharge of any accumulated water. Oil-only absorbent pads can be used to remove small amounts (e.g., sheen) of petroleum product from accumulated storm water. Leaking tanks shall be repaired without delay. Users of temporary tanks shall receive required oil-handlers training prior to bringing the tank onto WPAFB. Oil handler training is provided through the 88 CEG/CEIE STPM.

h. Dispensing of petroleum products shall be accomplished over an area impervious to the product and capable of preventing direct contact of the product with soil in the event of a spill or release.

i. All tanks shall have spill protection around the fill pipe and overfill protection in the form of a high level alarm with both an audible and visual signal and an automatic shutoff to stop flow at 90%

capacity of the tank unless otherwise authorized through the 88 CEG/CEIE STPM.

j. All ASTs shall have an automatic tank gauging system capable of monitoring product and water levels inside the tank and the interstitial space for double-wall tanks.

k. All USTs storing petroleum products shall meet requirements outlined in OAC 1301:7-9. All USTs shall have double wall construction and shall be equipped with an automatic tank gauging system for interstitial, product level, and water level monitoring. The UST system shall have a method, or combination of methods, for release detection that can detect a release from any portion of the tank and the connecting underground piping that routinely contains product. The UST system shall be equipped with both a visual and audible high level alarm to prevent overfills and a high liquid level pump cutoff device to stop flow at 90% full.

l. A State of Ohio Bureau of Underground Storage Tank Regulations (BUSTR) permit is required prior to engaging in any of the following with respect to USTs: An installation, an upgrade or modification, a permanent abandonment, a permanent removal, a replacement, a repair, a change in service or a temporary closure. Contact 88 CEG/CEIE STPM (937-257-5899) for additional information regarding permits.

m. The 88 CEG/CEIE STPM provides UST permitting support and submits tank permit and registration forms to the appropriate regulatory agencies. Contractors shall not submit any forms to the regulatory agencies unless first authorized to do so by the 88 CEG/CEIE STPM. Permit Applications for UST Work shall be submitted to 88 CEG/CEIE STPM at least 60 days prior to tank installation and contain design drawings of the UST system per Ohio BUSTR requirements. An UST registration form shall be submitted to the 88 CEG/CEIE STPM within 5 days after the tank is put into service.

3.9 CULTURAL RESOURCES

3.9.1 Inadvertent Discovery of Artififacts

If cultural or archaeological objects are encountered during a project, the Contractor shall immediately cease work in the discovery area; secure but not move the objects; and notify the Contracting Officer's representative and the 88 CEG/CEIE Cultural Resources Manager (CRM). The Government shall provide an in situ evaluation of the resources by a qualified archaeologist. Based on recommendations from the archaeologist and the State Historic Preservation Office, the CRM will advise the Contracting Officer's representative on further actions regarding the treatment of the objects.

3.9.2 Inadvertent Discovery of Human Remains

If human remains or objects are encountered during a project, the Contractor shall immediately cease work in the discovery area; secure but not move the objects; and notify the Contracting Officer's representative and the 88 CEG/CEIE CRM. The CRM shall in turn notify the installation commander, as the primary management authority, and the appropriate Native American organizations of the discovery. All activity in the area of the discovery shall be suspended for up to 30 days after certification that the appropriate Native American organizations have been notified.

Disposition and control of the remains or objects shall follow the requirements of Section 3, Subsections (a) and (b), of the Native American Graves Protection and Repatriation Act and the procedures set forth for this in the current version of the WPAFB Integrated Cultural Resources Management Plan (ICRMP). Contact the 88 CEG/CEIE CRM at 937-257-1374 for more information about the ICRMP.

3.10 NATURAL RESOURCES

3.10.1 Removing Trees

Tree removal shall take place only within the period of 1 October through 31 March. If tree removal must be accomplished at other times, the Contractor shall comply with direction provided by the Contracting Officer in coordination with the 88 CEG/CEIE Natural Resources Manager. Procedural requirements pertaining to tree removal outside the approved period may be extensive and time-consuming.

3.10.2 Projects located within the Huffman Retarding Basin

a. This contract does not involve site work within the boundary of the Huffman Retarding Basin as administered by the Miami Conservancy District (MCD).

b. For any site work within the Huffman Retarding Basin, the following shall apply: The volume of fill, topsoil, concrete, pavement, or other material placed at an elevation of 835.0' or lower within the retarding basin shall be less than or equal to the volume removed. When the contract requires either placement or excavation of material in a spoils area or borrow pit physically separate from the construction site, the Contractor shall provide a check made out to the Miami Conservancy District for payment of MCD fees applicable to preparation and approval of a Storage Compensation Agreement, and shall provide documentation of the actual net volume of material transferred to/from the construction site. The Government shall execute the final Storage Compensation Agreement with MCD.

-- End of Section --

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AUXANO ENVIRONMENTAL LLC.

Asbestos, Lead Based Paint and Hazardous Building Material Survey Report
Wright Patterson Air Force Base
AHU 5 Building 856
Contract Number: W912QR-17-D-0035

Submitted By:

and
Nichole Lashley,CHMM
Certified Asbestos Hazard Evaluation Specialist
Senior Environmental Specialist

Submitted To:
U.S. Army Corps of Engineers
Louisville District
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Draft January 18, 2019
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Revised Final December 20, 2022

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TABLE OF CONTENTS

LIST OF ACRONYMS

AAS	Atomic Absorption Spectrophotometry
ABIH	American Board of Industrial Hygiene
ACM	Asbestos Containing Material(s)
AHU	Air Handling Unit
AIHA	American Industrial Hygiene Association
Assessor(s)	Nichole Lashley, CMHH
ASTM	American Society for Testing and Materials
Auxano	Auxano Environmental LLC.
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
CFCs	Chlorofluorocarbon
CWR	Chilled Water Return
CWS	Chilled Water Supply
DL	Detection Limit
EPA	Environmental Protection Agency
FLB	Florescent Light Ballast
HUD	Housing and Urban Development
HVAC	Heating Ventilation Air Conditioning
HW	Hazardous Waste
IATL	International Asbestos Testing Laboratories
LBP	Lead Based Paint
LED	Light Emitting Diode
LOD	Limit of Detection
MCE	Mercury Containing Equipment
MG / CM^2	Milligrams Per Square Centimeter

MSDS	Material Safety Data Sheets
NESHAP	National Emissions Standard for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
OSHA	Occupational Safety and Health Administration
PACM	Presumed Asbestos Containing Material(s)
PCS	Performance Characteristics Sheet
PEL	Permissible Exposure Level
PPE	Personal Protective Equipment
PLM	Polarized Light Microscopy
RACM	Regulated Asbestos Containing Material(s)
PCB	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
SOW	Statement of Work
TCLP	Toxicity Characteristics Leaching Procedure
TSCA	Toxic Substance Control Act
UW	Universal Waste
UWR	Universal Waste Rule
USEPA	United States Environmental Protection Agency
VAV	Variable Air Volume
WPAFB	Wright Patterson Air Force Base

CONSTRUCTION SECTION ASBESTOS, LEAD BASED PAINT AND HAZARDOUS BUILDING MATERIAL SURVEY REPORT WRIGHT PATTERSON AIR FORCE BASE RENOVATION AHU #5 BUILDING 856

1.0 EXECUTIVE SUMMARY

1.1 ACM Overview

The EPA defines a homogeneous area as a surfacing material, thermal system insulation, or miscellaneous material that is uniform in color and texture. The use or application of the homogeneous area is also used to identify suspect ACMs. The EPA and the Occupational Health and Safety Administration (OSHA) define ACM as any material that contains more than one percent (by weight) of asbestos (>1%). Only one sample from a homogeneous area with an asbestos concentration >1% is required to collectively identify that material as an ACM.

The EPA additionally categorizes ACM as follows:

- Category I non-friable ACM – asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1% asbestos as determined using Polarized Light Microscopy.
- Category II non-friable ACM - any material, excluding Category I non-friable ACM, containing more than 1% asbestos as determined using the PLM method that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- Regulated asbestos-containing material (RACM) - (a) Friable asbestos material, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

Potential asbestos exposure in construction is regulated when construction, alteration, repair, maintenance, renovation or demolition of structures, substrates, or portions thereof contain asbestos [29 CFR 1926.1101 (a)(3)].

On December 17, 19 - 20, 2018 and January 3, 2019 Nichole Lashley, Ohio Department of Health (ODH) Certified Asbestos Hazard Evaluation Specialist (ES#34071), conducted an Asbestos ASTM E2356-10 for Pre-Construction Survey at Wright Patterson Air Force Base (WPAFB), Ohio 45433 for the upcoming HVAC project at Facility 10856. The following list summarizes the Asbestos Containing Materials (ACM) determined to be present *(Note: Functional space designations were declared by the assessor and may not represent actual user functional space declarations. Reference Appendix E and G for Asbestos Material Location Diagrams as they relate to Asbestos Containing Materials within the functional spaces identified by the assessor):*

The following Category I Non-Friable Asbestos Containing Materials (ACM) were determined within the confines of the project scope of work:

- **12” x 12” White with Black Specks Floor Tile** – W203, W203 A-E, W209, W210, W212, W214, W214A, W219, W220, W220 A-F, W298, and W299.

The following Category II Non-Friable ACM were determined within the confines of the project scope of work:

- **Black Floor Mastic** associated with 12" x 12" Tan and White w/ Black Speck Floor Tile - W203, W203 A-E, W209, W210, W212, W214, W214A, W219, W220, W220 A-F, W298, and W299.
- **White/Tan Adhesive on Duct Insulation –** Coating Fiberglass/Foil Duct Insulation Throughout (~1,849 ft²)
- **Gaskets Associated with Flanges and Valves –** AHU 5 (~10 ft²)
- **Duct Insulation Sealant (White Insulation and Adhesive)** – Applied on AHU 5 (~1,300 ft²)
- **Yellow Duct Mastic** – (~15 ft²) Applied on AHU 5 Duct Transition Seam
- **Grey Duct Mastic** – (~25 ft²) Applied on AHU 5 Seams on entire unit
- **Chilled Water Return (CWR) / Chilled Water Supply (CWS) Pipe Insulation White Sealant** – Applied on CWR / CWS Pipe Insulation Associated with AHU 5 (~ 5 fittings/elbows and 35 linear feet of pipe)
- **White Adhesive and Grey Duct Caulk on Variable Air Volume (VAV) Boxes –** Applied on Most VAV Boxes Throughout (~71 ft² and 10.25 ft² respectively)
- **Fire Doors** – Throughout (Not Anticipated to be Impacted via Renovation but found in the renovation space)
- **Sink Undercoating** – W202B and 228 (Janitors Closet) (Not Anticipated to be Impacted via Renovation but found in the renovation space)
- **Vibration Cloth** – AHU 5 Mechanical Room (~10 ft²)
- **Transite Contact Switches Associated with Electrical Panels** – (Not Anticipated to be Impacted via Renovation)
- **Black Roof Tar** – Roofing System (~400 ft²)

The following material was determined to contain less than 1% asbestos within the confines of the project scope of work:

- **Gray Caulk** – (~35 ft²) Inside AHU 5
- **White Jacketing** – (~480 ft²) AHU 5 Insulation on Exterior of Unit

Appendix E contains an **Inventory of ACM** detailing the locations, types, quantities, conditions, and friability of ACM determined to be within the limits of the scope of the renovation space. **Appendix F** contains photographic documentation representative of the materials found within the building. **Appendix G** contains illustrations of general ACM locations throughout the renovation areas. Additionally, removal of ACM material will need to comply with OSHA and WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

1.2 Lead Overview

Contractors impacting or disturbing painted substrates that would require grinding, sanding, scraping, abrasive blasting, welding, cutting and/or torch burning on existing paint of existing paint would need to comply with the OSHA Lead in Construction Standard, 29 CFR 1926.62. The OSHA Permissible Exposure Limit (PEL) for airborne lead exposure concentrations which has been established to be 50 micrograms per cubic meter and the OSHA Action Level has been established to be 30 micrograms per cubic meter. All contractors will be required to perform personal exposure monitoring when disturbing any existing painted substrates and components and compare sample results to the OSHA regulatory threshold levels and conduct

work practices accordingly. The construction debris must adhere to the WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

1.3 Hazardous Building Materials Overview

The following hazardous materials were reported by Auxano Environmental to be present within the renovation area within Facility 10856:

- Mercury Lamps (1148 each)
- Non-Mercury Switches (19 switches)
- Non-PCB Ballasts (523 each)
- High Intensity Light Bulbs (10 each)
- Battery Backup (5 each)
- Nuclear Detector on HVAC (12 each)

Removal and disposal of these items will need to follow WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

Appendix E contains a Hazardous Building Materials Inventory detailing the locations, types and quantities of the materials found. **Appendix F** contains photographic documentation representative of the materials found within the building.

1.4 Mold

On December 20, 2018 Ms. Lashley collected two bulk swab samples to determine the levels of surface mold present in the buildings HVAC system. The samples were submitted it to iATL, Mount Laurel, NJ to be analyzed for mold utilizing bioaerosol fungal contact plate.

Standard Chain-Of-Custody procedures were followed. The samples were labeled accurately and completely to match all information on the completed Chain-Of-Custody, including sample ID, sample time, date, type of analysis, project and samplers' name, and location.

The results indicated that *Epicoccum* mold was found in the duct work of the building. Epicoccum growths appear brown or black. Indoors, they grow on warm surfaces which feeds the colonies, which infest indoor air currents with spores. Inhaling this airborne fungus commonly found as a soil inhabitant but is also found in polluted water and carried by insects, it grows on plant leaves, decaying plant materials, uncooked fruit, textiles, paper products, and human skin; the health symptoms are congestion and runny nose that increase in the summer and early fall.

When colonies grow large enough, they will be visible as dark areas near the vents of the HVAC system. Large colonies were noted throughout the renovation space. If the duct work is to be removed as part of this project, it will need to be properly removed as part of its disposal. If any of the duct work is to remain it will need to be properly cleaned and re-tested prior to being put back into commission.

2.0 INTRODUCTION

On December 17, 19 - 20, 2018 and January 3, 2019 Nichole Lashley, Ohio Department of Health (ODH) Certified Asbestos Hazard Evaluation Specialist (ES#34071), conducted an Asbestos ASTM E2356-10 for Pre-Construction Survey at Wright Patterson Air Force Base (WPAFB), Ohio 45433 for the upcoming HVAC project at Facility 10856. The assessors' certifications and resumes are included in **Appendix A**.

The intent of this assessment effort was to identify all types, locations, and corresponding conditions of all ACM, PCBs, and other Hazardous Materials that are anticipated to be impacted or disturbed because of the project. The hazardous materials assessment was conducted in accordance with applicable Environmental Protection Agency (EPA) regulations. While the Asbestos assessment was completed in accordance with the National Emissions Standard Hazardous Air Pollutants (NESHAPs) and American Society for Testing and Materials (ASTM) E2356-14 Standard Practice for Comprehensive Building Asbestos Surveys. The ASTM outlines practices for three (3) types of ACM surveys: Baseline Surveys, Project Design Surveys, and Pre-Construction Surveys. The objectives established for each of these survey types differs based upon the significance and use intended for the survey. Based upon Auxano's interpretation of the ASTM E2356-14 Standard, the survey that was performed for this assessment effort would be classified, in part, as both a Project Design Survey and Pre-Construction Survey.

Prior to the assessment, Auxano was provided with a set of existing floor plans provided by Burns and McDonnell which were utilized by the assessor to identify the limits of the scope of work for the renovation, as well as to assist in determining building materials / components that are anticipated to be demolished / removed as part of this project.

2.1 Assumptions

The initial date of construction of Building 10856 was not known to the assessor but the building appeared to have characteristics indicative of circa 1970s construction. It was Auxano's understanding that various renovations have occurred to other AHUs as well as to various interior finishes; however, Auxano did not receive documentation indicative of these projects. Hence, all existing building materials were assessed. The following assumptions were made by the assessor as part of this assessment effort:

- All PACM were treated and sampled as separate homogenous areas since the dates of installation, maintenance, and change-out schedules were not known.
- Quantities of ACM are related to the anticipated impact or disturbance related to this renovation project.
- Possible ACM in inaccessible areas that were not visible (e.g. wall cavities, inside mechanical equipment, etc.) was not assessed.
- There was minimal continuity in the white/tan adhesive on the duct insulation found throughout functional spaces observed by the assessor. As part of this assessment effort, the assessor utilized her professional judgment when declaring homogenous areas as ACM within each respective functional space evaluated.

- Roofing materials, encapsulated piping, fire doors, gaskets, transite contact switches were assumed to contain ACM as sampling of these materials was either not feasible or sampling would have been destructive in nature.
- Determining the lead content of paints and coatings was not part of the scope of work for this project. All painted substrates and corresponding components were assumed to contain Lead Based Paint (LBP); no assumptions were made regarding any painting histories.

3.0 REGULATIONS

3.1 Environmental Protection Agency (EPA)

3.1.1 Asbestos NESHAP

In 1970's the United States Environmental Protection Agency (USEPA) Clean Air Act implemented regulations which banned and phased out various asbestos products; including, but not limited to spray-applied fireproofing and thermal systems insulation products. Pursuant to the Clean Air Act of 1970, the USEPA established the asbestos National Emissions Standard for Hazardous Air Pollutants (NESHAP), which has since been revised and updated in 1990. The intent of NESHAP is to minimize the release of asbestos fibers during activities involving handling of asbestos and specifies work practices to be followed during renovation, demolition, or other abatement activities when friable asbestos is involved.

The following EPA terminology and corresponding definitions are relative to ACM that have been identified within the renovation areas:

- **RACM** – any friable ACM containing more than one percent asbestos as determined using PLM according to the method specified in Appendix A, Subpart F, 40 Code of Federal Regulations (CFR) Part 763 (Sec. 61.141).
- **Category I Non-Friable ACM** – any asbestos-containing gasket, resilient floor covering or asphalt roofing product that contains more than 1% asbestos as determined using PLM according to the method specified in Appendix A, Subpart F, 40 CFR Part 763 (Sec. 61.141).
- **Category II Non-Friable ACM** – Any material, excluding Category I Non-Friable ACM, containing more than 1% asbestos as determined by the methods specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, PLM that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

ACM material that has been identified for removal the OEPA asbestos program licenses and certifies companies directly involved with the asbestos abatement industry. The program regulates asbestos abatement contractors, supervisors, workers, building inspector / management planners, and air monitoring technicians. In addition, OEPA conducts random asbestos abatement project audits and reviews asbestos contractor licenses, certifications, medical, fit testing, and the asbestos abatement project.

The Ohio EPA notification of demolition and renovation form is required for:

- **Every demolition of a facility, regardless of whether asbestos is involved. This includes all structures that will be intentionally burned for fire training purposes.**
- **A renovation when the amount of regulated asbestos-containing material (RACM) stripped, removed, dislodged, cut, drilled, or similarly disturbed exceeds 260 linear feet on pipes or 160 square feet on other facility components or 35 cubic feet off facility components.**
- **An abatement when the activity involves the removal, renovation, enclosure, repair or encapsulation of friable asbestos-containing material in an amount greater than 50 linear feet on pipes or 50 square feet on other facility components.**

State regulations for Asbestos Hazard Abatement Contractors, Specialists, and other professionals are included in Chapter 3745-22 of the OAC. Additionally, WPAFB standard specification section 01 35 43 (General Environmental Protection Requirements) needs to be followed during the project.

3.1.2 Universal Wastes

Auxano performed a visual inspection of existing building equipment for the presence of other hazardous materials and Universal Wastes [pursuant to 40 CFR 273.9, and 40 CFR 260.10]. The survey was limited to above grade only and did not include a soil or subsurface investigation. Materials evaluated as part of this inspection included: Polychlorinated Biphenyl (PCB) containing units such as lighting ballasts and PCB-containing electrical units (i.e., electrical transformers); lead-containing units such as car batteries or emergency exit sign batteries; fluorescent lighting tubes; mercury containing units such as light switches and thermostats; refrigerants, halon, and other Chlorofluorocarbons (CFCs) such as fire extinguishing systems and Freon® used in association with building drinking fountains; heavy metals as may be found in cooling tower water treatment systems; solvents, paints, fuel (storage tanks), lubricants, and other associated maintenance and cleaning products; radioactive materials that may be contained in units such as smoke detectors, emergency exit signs, or medical equipment; office materials, supplies, and equipment such as computer monitors and printing supplies, and miscellaneous materials such as unlabeled materials or substances of concern.

Universal wastes (UW) are specific hazardous waste streams that a generator can choose to manage in an alternative manner in place of the more complex hazardous waste requirements. The Universal Waste Rules (UWR) are intended to promote recycling as well as proper disposal by easing certain regulatory requirements. Ohio's UWRs are in Ohio Administrative Code (OAC) Chapter 3745-273.

If the material such as PCBs cannot meet the UW specific waste stream it must be disposed of a Hazardous Waste. Disposal requirements for WPAFB are found in the standard specification sections 01 35 43 (General Environmental Protection Requirements).

3.2 <u>Occupational Safety and Health Administration (OSHA)</u>

3.2.1 Asbestos

OSHA has been involved with controlling work exposure to asbestos since 1971. The 29 CFR 1926.1101 Construction Industry Standard for Asbestos was introduced in 1994. Provisions covered in this standard include asbestos worker protection for those involved with disturbing asbestos, protection of those employees working around asbestos, exposure assessments, periodic monitoring, medical surveillance, work procedures, respiratory protection, personal protective equipment, hazard communication, housekeeping, recordkeeping, and competent person responsibilities. Note that OSHA regulates building materials containing any percentage or amount of asbestos, including all materials less than one percent asbestos. Additionally, WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements) needs to be followed during the project.

3.2.2 Lead Based Paint (LBP)

OSHA's definition of an LBP includes all paints, varnishes, stains, lacquers, or coatings containing any concentration of lead greater than zero percent. All contractors impacting existing LBP coated surfaces need to comply with the OSHA Lead in Construction Standard (29 CFR 1926.62). The OSHA Permissible Exposure Limit (PEL) for airborne lead exposure concentrations has been established to be 50 micrograms per cubic meter and the OSHA Action Level has been established to be 30 micrograms per cubic meter. All contractors will be required to perform personal exposure monitoring when disturbing any existing painted substrates and components and compare sample results to the OSHA regulatory threshold levels and conduct work practices accordingly. This standard has been developed to protect workers from potential exposures to lead. Additionally, WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements) needs to be followed during the project.

4.0 ASBESTOS SAMPLING AND RESULTS

Rooms, functional spaces, and components were assessed and surveyed for the presence of ACM. Bulk samples of suspect ACM were collected to confirm or deny the presence of asbestos. All samples were placed into clean sealed bags and identified with a unique sample number. Sampling tools were decontaminated between each sampling episode. Sixty (60) bulk samples (including all layers) of twenty-four (24) homogeneous areas were collected by an ODH Licensed Asbestos Hazard Evaluation Specialist in accordance with current EPA (40 CFR 61, Subpart M) and OSHA 29 CFR 1926.1101 requirements and sampling protocol. **Appendix B** contains **Sample Location Diagrams**. Samples of suspect building materials collected as part of this assessment effort are included within **Appendix C – Table 1: Building Materials Bulk Sampled.**

4.1 Confirmed Asbestos Containing Materials

Bulk samples collected for this assessment were analyzed via International Asbestos Testing Laboratories (IATL) accredited National Voluntary Laboratory Accreditation Program (NVLAP) laboratory using Polarized Light Microscopy (PLM) Method EPA 600 R-93/116, 1993. Positive analyses result for asbestos associated with these sampling efforts are listed below:

- 12” x 12” White with Black Specks Floor Tile - W203, W203 A-E, W209, W210, W212, W214, W214A, W219, W220, W220 A-F, W298, and W299
- Black Floor Mastic associated with 12” x 12” Tan and White w/ Black Speck Floor Tile - W203, W203 A-E, W209, W210, W212, W214, W214A, W219, W220, W220 A-F, W298, and W299
- White/Tan Adhesive on Duct Insulation – Coating Fiberglass/Foil Duct Insulation Throughout (above ceiling)
- Duct Insulation Sealant (White Insulation and Adhesive) – Applied on AHU 5
- Yellow Duct Mastic – Applied on AHU 5 Duct Transition Seam
- Grey Duct Mastic – Applied on AHU 5 Seams on entire unit
- Chilled Water Return (CWR) / Chilled Water Supply (CWS) Pipe Insulation White Sealant – Applied on CWR / CWS Pipe Insulation Associated with AHU 5

Appendix C – **Table 2: Laboratory Confirmed ACM. Laboratory Certificates of Analysis** and corresponding **Chain of Custodies** are included within **Appendix D**. **Appendix E** contains a comprehensive **Inventory of ACM** throughout the anticipated demolition areas.

4.2 Assumed Asbestos Containing Materials

Various building materials were assumed as ACM as part of this assessment effort. These building materials were assumed to contain ACM based upon one or more of the following factors: lack of accessibility to sample, or if the area was un-safe (worker protection) to sample. The following list represents the assumed ACM within the renovation areas for this project:

- Fire Doors – Throughout (Not Anticipated to be Impacted via Renovation)
- Sink Undercoating – W202B and 228 (Janitors Closet – Not Anticipated to be Impacted via Renovation)
- Transite Contact Switches Associated with Electrical Panels – (Not Anticipated to be Impacted via Renovation)
- Gaskets Associated with Flanges and Valves – AHU 5
- Vibration Cloth – AHU 5 Mechanical Room
- White Adhesive and Grey Duct Caulk on Variable Air Volume (VAV) Boxes – Applied on Most VAV Boxes Throughout
- Black Roof Tar – Roofing System

Reference **Appendix E** - **Inventory of ACM**, which includes the locations, quantities, conditions, and corresponding NEHSAP categories of these materials throughout the facility.

4.3 Non-Asbestos Containing Materials

Building materials that were bulk sampled and reported by the laboratory to contain no asbestos content are inventoried within **Appendix C – Table 3: Non-Asbestos Containing Materials.**

4.4 Material Containing Less Than 1% Asbestos

The following building material was reported by the laboratory to contain less than 1% asbestos.

- Gray Caulk – Inside AHU 5 (~35 ft²)
- White Jacketing - Applied on AHU 5 Insulation Exterior of Unit (~480 ft²)

Building materials containing less than 1% asbestos are not regulated by the OEPA; however, are regulated by OSHA. OSHA regulates building materials containing any amount of asbestos greater than 0%. Some of the provisions required by OSHA during abatement (removal) of materials containing less than 1% asbestos include but are not limited to: personal exposure air monitoring, respiratory protection (if air monitoring results are in excess of the OSHA Permissible Exposure Limit), wet methods of removal, and disposal of materials containing asbestos into leak-tight containers. Although the regulations do not require than an Ohio Certified Asbestos Abatement Contractor perform abatement of materials containing less than 1% asbestos, Auxano recommends that one is utilized based upon the that following factors: ACM greater than 1% has been reported throughout the building, complexity of the OSHA regulations, and to reduce the owner's liability.

5.0 ACM CONCLUSIONS

The following conclusions represent the assessor's professional judgment regarding the existing ACM anticipated to be impacted or disturbed as a result of this renovation project. Reference **Appendix E – Inventory of ACM, Appendix F – Photographs,** and **Appendix G – Asbestos Material Location Diagrams.**

5.1 ACM White/Tan Adhesive on Duct Insulation

Approximately **1,849 ft²** of Category II Non-Friable ACM White/Tan Adhesive on Duct Insulation was determined to be present on most of the duct throughout the renovation areas. Some of the functional spaces had appeared to have been renovated such as W298 (where no ducting was found); therefore, this ACM was not observed to be present within this room. In general, most of the ACM White/Tan Adhesive on Duct Insulation throughout the renovation areas were evaluated to be intact.

Since this is a replacement project of AHU-5 it is understood that some of the duct work might need to be removed and replaced for the new unit to function properly. All Category II ACM White/Tan Adhesive on Duct Insulation anticipated to be removed for this renovation project must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove the ACM White/Tan Adhesive on Duct Insulation in conjunction with all the fiberglass duct insulation since it does not seem reasonably feasible to have the abatement contractor separate the ACM from the fiberglass duct insulation during conventional abatement work practices. With the addition of the fiberglass insulation approximately **5,343 ft²** of material will need to be remediated as part of this project if all the duct work is to be removed. In locations where construction boundaries are erected segregating work areas from non-work areas, the abatement contractor will be required to conduct partial removal of this ACM to the extent of the limits of construction and then seal and encapsulate any exposed portions of remaining ACM insulation to an intact condition.

5.2 Duct Insulation (White Insulation and Adhesive) Associated with AHU #5

Approximately **1,300 ft²** of Category II ACM Duct Insulation Wrap and Adhesive associated with AHU #5 was determined to be present within W299 (Mechanical Room). Auxano staff evaluated this ACM to be intact as part of this assessment effort. It is anticipated that AHU #5 will be removed as part of this renovation; hence, this ACM must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove the ACM Duct Insulation Wrap Adhesive in conjunction with the white insulation around the unit.

5.3 ACM CWR / CWS Pipe Insulation White Sealant Associated with AHU #5

Damaged pipe joints and insulation around the pipes were observed in Mechanical Room W299 (Piping associated with AHU#5). **5 pipe joints/fittings and 36 linear feet** of piping were noted in this location.

Therefore, this ACM must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove the ACM CWR / CWS Pipe Insulation White Sealant in conjunction with the fiberglass pipe insulation since it does not seem reasonably feasible for the abatement contractor to separate the ACM from the fiberglass pipe insulation during conventional abatement work practices.

5.4 ACM Mastic Associated with AHU #5

Category II ACM Mastic associated with AHU #5 was determined to be present within W299. The following were types of mastic identified:

- Yellow Duct Mastic – ~**15 ft²** applied on AHU #5 duct transition seam
- Grey Duct Mastic – ~**25 ft²** applied on AHU #5 seams on entire unit

All these ACMs were evaluated by Auxano staff to be intact as part of this assessment effort. It is anticipated that AHU #5 will be removed as part of this renovation; hence, these ACMs must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove these ACM Mastics selectively without removing the entire system upon which ACMs were applied.

5.5 ACM Gaskets Associated with Flanges and Valves – AHU #5

Category I Non-Friable ACM Gaskets associated with Flanges and Valves were assumed to be present within W299. These components were located on the Water piping systems related to AHU #5. Approximately **10 ft²** of gaskets were assumed to contain ACM since bulk sampling these materials would require the dismantlement of flanges and valves to access successfully. Each gasket would need to be treated as a separate homogenous area and sampled accordingly to prove that the materials contain no asbestos content, especially since the gasket installation date(s), change out, and maintenance schedules were not known. The condition of the ACM gaskets was unknown since they were encased within metal. Due to the minimal cost impact, the abatement of the ACM gaskets would have on the overall project cost, the assessor recommends that the gaskets are removed and disposed of as ACM by an Ohio Licensed Asbestos Abatement Contractor prior to commencement of demolition. Bulk sampling each of the gaskets for asbestos would not be realistically obtainable in the assessor's professional judgment, based upon the quantity of gaskets related to the variety of different building systems and perceived unknown maintenance change-out schedules.

5.6 ACM Transite Contact Switches Associated with Electrical Panels

Category II Non-Friable ACM Transite Electric Switchgear Panels were assumed to be present within all electrical panels throughout the renovation areas. Based upon Auxano's understanding of the scope of work for this project, the following electrical feeders are anticipated to be removed:

- Feeder from MCC-5 to AHU #5 (W299/W225A) – approximately **120 ft²**

Additional electrical panels were observed in miscellaneous locations throughout the project scope areas; however, Auxano does not anticipate that these panels will be impacted or disturbed as part of this renovation effort.

To confirm the presence of the ACM within the panels, the panels would need to be de-energized and dismantled. The condition of the ACM was unknown since the material is encased within the metal electric switch panels. Since cost impact of assuming these panels as ACM is minimal by comparison to the known hazardous material abatement scope of work for this project, Auxano recommends that these Transite Contact Switches remain as an assumed ACM and be removed and disposed of by on Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices.

5.7 ACM White Adhesive / Grey Caulk on Variable Air Volume (VAV) Boxes

Category II Non-Friable ACM White Adhesive (~**71 ft²**) and Grey Caulk (~**10.25 ft²**) were determined to be present on most of the VAV Boxes throughout the renovation areas. Some of the functional spaces had appeared to have been renovated such as W299; therefore, this ACM was not observed to be present within this area. Auxano staff did not observe any damage to these ACMs during this assessment effort.

All ACM Category II Non-Friable ACM White Adhesive and Grey Caulk anticipated to be demolished for this renovation project must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove these ACMs in conjunction with removal of the VAV boxes since it does not seem reasonably feasible to have the abatement contractor separate these ACMs from the VAV boxes during conventional abatement work practices.

5.8 ACM Fire Doors

Category II Non-Friable ACM Fire Doors were assumed to be present within most of the door systems throughout the renovation areas. Fire doors were assumed to contain ACM since sampling of the fire doors would entail destructive methods that would destroy the integrity of the door and corresponding fire rating. Auxano evaluated all ACM Fire Doors to be intact as part of this assessment effort. The fire doors and metal casings were rated between 1.5 to 2 hours and were found predominantly along corridor hallways. Based upon Auxano's understanding of the scope of work related to this renovation, it is anticipated that no fire doors will be removed but the contractor should be aware of their presence.

5.9 ACM 12" x 12" White with Black Specks Floor Tile / ACM Black Mastic

Category I Non-Friable ACM White with Black Specks Floor Tile / Category II Non-Friable ACM Black Mastic was determined to be present throughout most functional spaces impacted by this renovation project. Except for a few functional spaces, most of these ACMs were found to be present beneath carpeting. The scope of work for this renovation project does not include the tile removal under the carpet but some tiles might come off when the carpet is removed. Therefore, the contractor should be made aware of its presence within the functional space.

5.10 ACM Mastic Associated with Spray-on Sink Insulation

This Category II Non-Friable Materials was observed within the janitor's closet's W202B and W228. The undercoating mastic associated with the sink was assumed to contain ACM due to lack of accessibility. It is not anticipated that this material will be removed or disturbed during this phase of the contract.

As part of the OSHA Hazardous Communications Standard, the presence and location of these ACMs must be made available to all workers in performing work near the areas where these ACMs are present. **Appendix E – Inventory of ACM** contains a listing of the presence and location of where these ACMs were observed by Auxano to be present. If a change in the scope of work that would constitute removal of these ACMs, an Ohio Licensed Asbestos Abatement Contractor should be engaged to conduct proper removal of these materials.

5.11 ACM Roofing Tar

Category II Non-Friable Roofing Tar was confirmed to be present covering approximately **400 ft²** of the roofing structure where roof penetrations are to occur. The roofing appeared to be constructed as flat rolled roofing system.

Removal of ACM Roofing Systems does not require an Ohio Licensed Asbestos Abatement Contractor. Regulations allow for other contractors to perform this work if a Certified Asbestos Hazard Abatement Supervisor oversees removal and disposal and workers have successfully completed an 8-hour asbestos roofing removal course within a 12-month period of performing the work. Additionally, WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements) must be followed.

5.12 ACM Vibration Cloth

Approximately **10 ft²** of Category II Non-Friable vibration cloth associated with AHU #5 Mechanical Room W299 was assumed to contain ACM since bulk sampling this material would require the dismantlement of equipment to access them successfully. Each cloth would need to be treated as a separate homogenous area and sampled accordingly to prove that the materials contain no asbestos content, especially since the installation date(s), change out, and maintenance schedules were not known. Auxano recommends the vibration cloth remain as an assumed ACM and be removed and disposed of by on Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices.

6.0 ENVIRONMENTAL LEAD AND LEAD-BASED PAINT CONCLUSIONS

The following are conclusions regarding existing LBP anticipated to be impacted or disturbed because of the upcoming renovation project at Facility 10856:

- OSHA regulates LBP with concentrations greater than zero percent;
- All contractors impacting, or disturbing painted substrates / components will need to comply with the OSHA Lead in Construction Standard, 29 CFR 1926.62;

The OSHA Permissible Exposure Limit (PEL) for airborne lead exposure concentrations has been established to be 50 micrograms per cubic meter and the OSHA Action Level has been established to be 30 micrograms per cubic meter. All contractors will be required to perform personal exposure monitoring when disturbing any existing painted substrates and components and compare sample results to the OSHA regulatory threshold levels and conduct work practices accordingly.

7.0 HAZARDOUS BUILDING MATERIALS

7.1 Lamps

This category includes hazardous waste lamps that meet the definition in OAC rule 3745-50-10(A). Lamps are defined as the bulb or tube portion of an electric lighting device. A lamp is designed to produce radiant energy, most often in the ultraviolet, visible and infra-red regions of the electromagnetic spectrum. Lamps can exhibit the toxicity characteristic for some heavy metals (i.e., mercury, lead, cadmium). Examples of universal waste lamps include incandescent, fluorescent, high intensity discharge, neon, mercury vapor, and high-pressure sodium and metal halide lamps.

During the site visit 1,148 mercury fluorescent lamps and 10 high intensity discharge bulbs were recorded within the demolition area. A location map can be found in **Appendix H** and quantities per room are reported in **Appendix E**. Removal and disposal of these items will need to follow WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

7.2 Batteries

This category includes hazardous waste batteries such as nickel-cadmium batteries and spent lead-acid batteries. The handler has the option of managing discarded lead-acid batteries under OAC Chapter 3745-273 (the UWR), or OAC rule 3745-266-80. UW batteries are defined in OAC rule 3745-50-10(A) and OAC rule 3745-273-09 as devices consisting of one or more electrically connected electrochemical cells that are designed to receive, store and deliver electric energy. An electrochemical cell consists of an anode, cathode and electrolyte. A device is also considered a battery if it is intact, unbroken and all of the electrolyte has been removed. These materials will need to be disposed of in accordance with UWR and disposed of in accordance with WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements) prior to demolition.

During the site visit 5 emergency lights that had back-up battery sources were recorded within the renovation areas. A location map can be found in **Appendix H** and quantities per area are reported in **Appendix E.**

7.3 Polychlorinated Biphenyls (PCB) Equipment

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs were domestically manufactured from 1929 until their manufacture was banned in 1979. They have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints,

plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and many other industrial applications.

During the site visit 523 non-PCB light ballast were discovered within the renovation areas. A location map can be found in **Appendix H** and quantities per area are reported in **Appendix E.** Removal and disposal of these items will need to follow WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

7.4 Mercury-Containing Thermostats

Mercury-containing thermostats are temperature control devices that contain metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules removed from temperature control devices in compliance with the UWR and disposed of in accordance with WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements) prior to demolition.

During the site visit 19 non-mercury thermostats were identified. A location map can be found in **Appendix H** and quantities per room are reported in **Appendix E**.

7.5 Ozone-Depleting Refrigerants

A chlorofluorocarbon (CFC) is an organic compound that contains only carbon, chlorine, and fluorine, produced as a volatile derivative of methane, ethane, and propane. They are also commonly known by the DuPont brand name Freon. The most common representative is dichlorodifluoromethane (R-12 or Freon-12). Many CFCs have been widely used as refrigerants, propellants (in aerosol applications), and solvents. Because CFCs contribute to ozone depletion in the upper atmosphere, the manufacture of such compounds has been phased out under the Montreal Protocol, and they are being replaced with other products.

During the site no ozone refrigerants were discovered at the site.

7.6 Fire and/or Smoke Detectors with Radioactive Sources

Smoke detectors and alarms are important safety devices. Ionization chamber and photoelectric smoke detectors are the two most common types available commercially.

Photoelectric technology smoke alarms use a T-shaped chamber fitted with a light-emitting diode (LED) and a photocell. The LED sends a beam of light across the horizontal bar of the chamber. The photocell sits at the bottom of the vertical portion of the chamber. The photocell will generate a current, when exposed to light.

Ionization sensor smoke alarms contain a small amount of radioactive material, americium embedded in a gold foil matrix within an ionization chamber. The matrix is made by rolling gold and americium oxide ingots together to form a foil approximately one micrometer thick. This thin gold-americium foil is then sandwiched between a thicker (~0.25 millimeter) silver backing and a 2-micron thick palladium laminate. This is

thick enough to completely retain the radioactive material, but thin enough to allow the alpha particles to pass.

During the site visit 12 radioactive fire detectors were encountered most of which were in room W298. A location map can be found in **Appendix H** and quantities per room are reported in **Appendix E**. Removal and disposal of these items will need to follow WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

7.7 Mold

On December 20, 2018 Ms. Lashley collected two bulk swab samples to determine the levels of surface mold present in the buildings HVAC system. The samples were submitted it to iATL, Mount Laurel, NJ to be analyzed for mold utilizing bioaerosol fungal contact plate.

Standard Chain-Of-Custody procedures were followed. The samples were labeled accurately and completely to match all information on the completed Chain-Of-Custody, including sample ID, sample time, date, type of analysis, project and samplers' name, and location.

The results indicated that *Epicoccum* mold was found in the duct work of the building. Epicoccum growths appear brown or black. Indoors, they grow on warm surfaces which feeds the colonies, which infest indoor air currents with spores. Inhaling this airborne fungus commonly found as a soil inhabitant but is also found in polluted water and carried by insects, it grows on plant leaves, decaying plant materials, uncooked fruit, textiles, paper products, and human skin; the health symptoms are congestion and runny nose that increase in the summer and early fall. It is anticipated that most of the existing duct work is going to be removed as part of this project so If any of the existing duct work is to remain it will need to be cleaned and re-tested prior to being put back into service.

8.0 RECOMENDATIONS

8.1 Asbestos

"Regulated asbestos-containing material" means:
(a) Friable asbestos material;
(b) Category I nonfriable asbestos-containing material that has become friable;
(c) Category I nonfriable asbestos-containing material that will be or has been subjected to sanding, grinding, cutting, or abrading; or
(d) Category II non-friable asbestos-containing material that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material during demolition or renovation operations regulated by OAC chapter 3745-20-01.

The Ohio EPA notification of demolition and renovation form is required for:

- **Every demolition of a facility, regardless of whether asbestos is involved. This includes all structures that will be intentionally burned for fire training purposes.**
- **A renovation when the amount of regulated asbestos-containing material (RACM) stripped, removed, dislodged, cut, drilled, or similarly disturbed exceeds 260 linear feet on pipes or 160 square feet on other facility components or 35 cubic feet off facility components.**
- **An abatement when the activity involves the removal, renovation, enclosure, repair or encapsulation of friable asbestos-containing material in an amount greater than 50 linear feet on pipes or 50 square feet on other facility components.**

State regulations for Asbestos Hazard Abatement Contractors, Specialists, and other professionals are included in Chapter 3745-22 of the OAC. Additionally, WPAFB standard specification section 01 35 43 (General Environmental Protection Requirements) needs to be followed during the project.

8.2 Lead Based Paint

All contractors impacting or disturbing painted substrates that would require grinding/sanding/scraping of existing paint would need to comply with the OSHA Lead in Construction Standard, 29 CFR 1926.62. The OSHA Permissible Exposure Limit (PEL) for airborne lead exposure concentrations which has been established to be 50 micrograms per cubic meter and the OSHA Action Level has been established to be 30 micrograms per cubic meter. All contractors will be required to perform personal exposure monitoring when disturbing any existing painted substrates and components and compare sample results to the OSHA regulatory threshold levels and conduct work practices accordingly. The construction debris must adhere to the WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

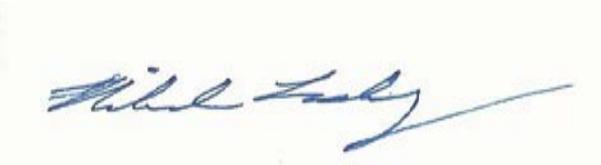
8.3 Other Hazards

The contractor will be responsible for the complete removal, recycling and/or disposal of Hazardous Building Materials. Removal and disposal of these items will need to follow WPAFB standard specification sections 01 35 43 (General Environmental Protection Requirements).

9.0 REPORT RELIANCE

This document was prepared for the use of Burns and McDonnell and can be relied upon by Burns and McDonnell and their client as the end user of this report. Auxano assures that the scope of the investigation and contents included within the report are in conformance with accepted requirements and follow the generally accepted standards and practices of environmental consultants. The statements contained in the report are true and accurate to the best of our knowledge.

Sincerely,



Nichole Lashley
Senior Environmental Scientist
Auxano Environmental LLC.

APPENDIX A-1

ASSESSOR AND LAB CERTIFICATIONS

Ohio Environmental Protection Agency

Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

6/16/2022

Nichole Lashley
4222 Lantana Dr.
Lebanon, OH 45036

RE: Evaluation Specialist
Certification Number: ES34071
Expiration Date: 8/3/2023

Dear Nichole Lashley:

This letter and enclosed certification card approves your request to be certified as an asbestos Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Ohio Environmental Protection Agency (EPA) for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please contact the Asbestos Program at 614-644-0226 or by email at asbestoslicensing@epa.ohio.gov.

Sincerely,

Joshua S. Koch
Manager, Business Operations Support Section
Ohio EPA - Division of Air Pollution Control

e 700 • P.O. Box 1049 • Columbus, OH 43216-1049
epa.ohio.gov • (614) 644-3020 • (614) 644-3184 (fax)

IHMM
INSTITUTE OF HAZARDOUS MATERIALS MANAGEMENT

THIS CERTIFIES THAT

NICHOLE LASHLEY

HAS SUCCESSFULLY MET ALL THE REQUIREMENTS OF EDUCATION, EXPERIENCE AND EXAMINATION, AND IS HEREBY DESIGNATED A

CERTIFIED HAZARDOUS MATERIALS MANAGER®
CHMM®

July 1, 2019
DATE OF CERTIFICATION

24829
CREDENTIAL NUMBER

July 31, 2024
CERTIFICATION EXPIRES

EUGENE A. GUILFORD, JR.
EXECUTIVE DIRECTOR

VALID SO LONG AS THIS CREDENTIAL IS RENEWED ACCORDING TO SCHEDULE AND IS NOT OTHERWISE REVOKED.

ANSI
ANSI Accredited Program PERSONNEL CERTIFICATION

Accredited by the American National Standards Institute and the Council of Engineering and Scientific Specialty Boards

CESB

September 30, 2019

Laboratory ID: 100188

Frank Ehrenfeld
International Asbestos Testing Laboratories (IATL)
9000 Commerce Parkway, Suite B.
Mt. Laurel, NJ 08054

Dear Mr. Ehrenfeld:

Congratulations! The AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC's Analytical Accreditation Board (AAB) has approved International Asbestos Testing Laboratories (IATL) as an accredited Industrial Hygiene, Environmental Lead, and Environmental Microbiology laboratory.

Accreditation documentation includes the IHLAP, ELLAP, and EMLAP accreditation certificate, scope of accreditation document and a copy of the current AIHA-LAP, LLC license agreement (if your completed agreement is not on file at AIHA-LAP, LLC). The accreditation symbol has been designed for use by all AIHA-LAP, LLC accredited laboratories. If your laboratory chooses to use the symbol in its advertising the laboratory's accreditation, you must complete and return the AIHA-LAP, LLC license agreement to a Laboratory Accreditation Specialist. Once submitted, an electronic copy of the accreditation symbol will be sent to you.

Laboratory accreditation shall be maintained by continued compliance with IHLAP, ELLAP, and EMLAP requirements *(see Policy Modules 2B, 2C, 2D, and 6),* which includes proficient participation in AIHA-LAP, LLC approved proficiency testing, demonstration of competency, or round robin program as indicated on the AIHA-LAP "Approved PT and Round Robin" webpage, its associated Scope/PT table, and as required in Policy Module 6, for all Fields of Testing (FoTs) for which the laboratory is accredited. An accredited laboratory that wishes to expand into a new FoT must submit an updated accreditation application to AIHA-LAP, LLC for review by the AAB.

Any changes in ownership, laboratory location, personnel, FoTs/Methods, or significant procedural changes shall be reported to AIHA-LAP, LLC in writing within twenty (20) business days of the change.

The accreditation certificate is the property of AIHA-LAP, LLC and must be returned to us should your laboratory withdraw or be removed from the IHLAP, ELLAP, and EMLAP.

Again, congratulations. If you have any questions, please contact Drake McGregor, Laboratory Accreditation Specialist, at (703) 846-0739.

Sincerely,

Cheryl O. Morton

Cheryl O. Morton
Managing Director

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

International Asbestos Testing Laboratories (IATL)

9000 Commerce Parkway, Suite B, Mt. Laurel, NJ 08054

Laboratory ID: LAP-100188

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: November 01, 2023
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: November 01, 2023
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: November 01, 2023
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:
☐	**BERYLLIUM FIELD/MOBILE**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O. Morton

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision19.1: 07/28/2021

Date Issued: 12/01/2021

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

International Asbestos Testing Laboratories (IATL)

9000 Commerce Parkway, Suite B, Mt. Laurel, NJ 08054

Laboratory ID: **100188**
Issue Date: 09/30/2019

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 03/01/1991

IHLAP Scope Category	**Field of Testing (FoT)** (FoTs cover all relevant IH matrices)	**Technology sub-type/ Detector**	**Published Reference Method/Title of In-house Method**	**Method Description or Analyte** *(for internal methods only)*
Spectrometry Core	Atomic Absorption	FAA	NIOSH 7082	
	X-ray Diffraction (XRD)		NIOSH 7500	
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)		EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)		NIOSH 7400	
	Transmission Electron Microscopy (TEM)		NIOSH 7402	

A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

International Asbestos Testing Laboratories (IATL)
9000 Commerce Parkway, Suite B, Mt. Laurel, NJ 08054

Laboratory ID: **100188**
Issue Date: 09/30/2019

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air and composited wipes analyses are not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/20/1997

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description (*for internal methods only*)
Paint		ASTM D3335-85a	
Soil		EPA SW-846 3050B	
		EPA SW-846 7000B	
Settled Dust by Wipe		EPA SW-846 3050B	
		EPA SW-846 7000B	
Airborne Dust		NIOSH 7082	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

International Asbestos Testing Laboratories (IATL)
9000 Commerce Parkway, Suite B, Mt. Laurel, NJ 08054

Laboratory ID: **100188**
Issue Date: 09/30/2019

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Environmental Microbiology Laboratory Accreditation Program (EMLAP)

Initial Accreditation Date: 12/01/2013

EMLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Fungal	Air - Direct Examination	ASTM D7391-09	
	Bulk - Direct Examination	ASTM D7391-09	
	Surface - Direct Examination	ASTM D7391-09	

A complete listing of currently accredited Environmental Microbiology laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101165-0

International Asbestos Testing Laboratories

Mt. Laurel, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

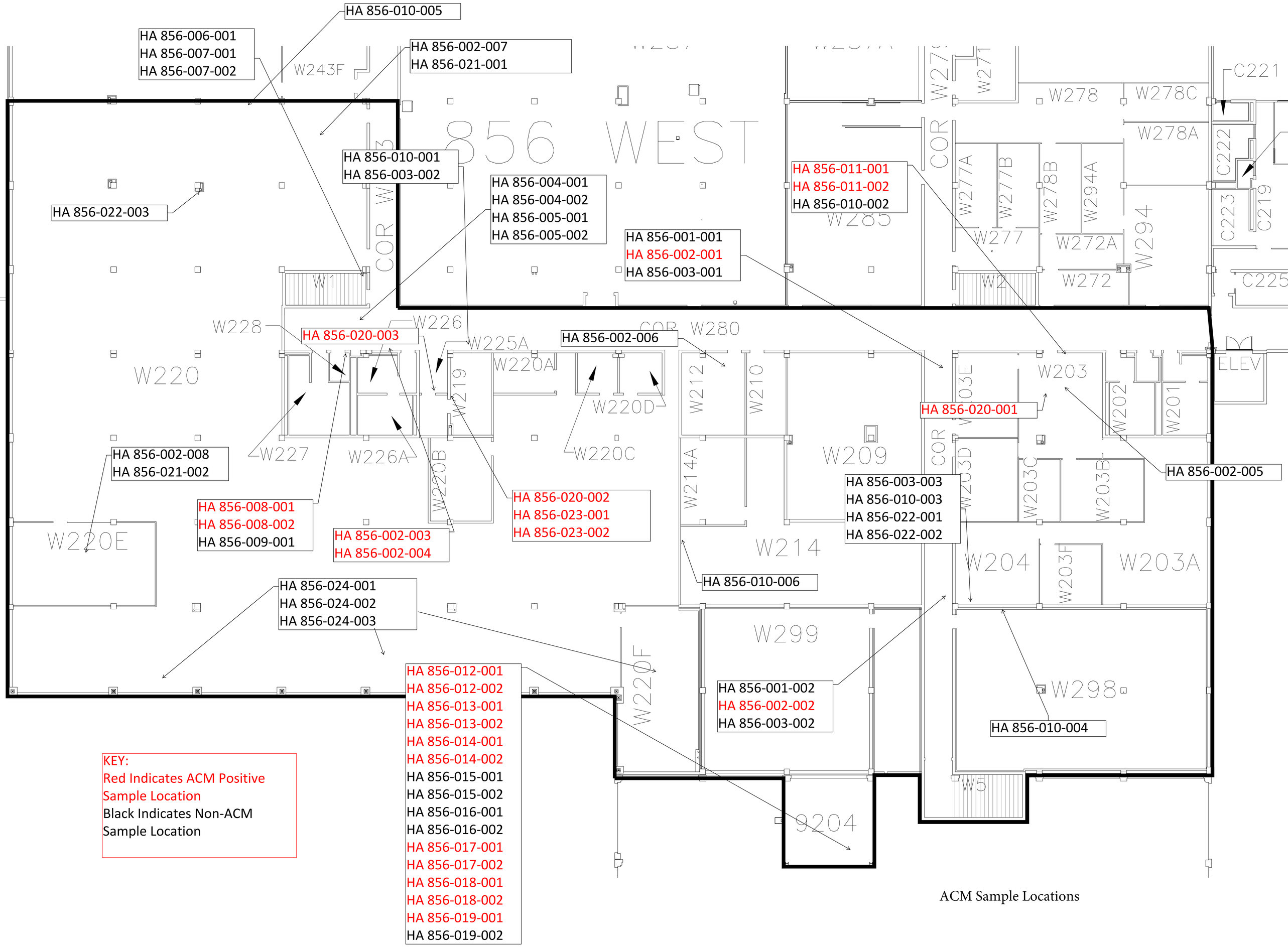
2022-07-01 through 2023-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

APPENDIX B-2

SAMPLE LOCATION DIAGRAMS



ACM Sample Locations

APPENDIX C-3

TABLE 1: BUILDING MATERIALS BULK SAMPLED
TABLE 2: LABORATORY CONFIRMED ACM
TABLE 3: NON-ACM

TABLE 1: BUILDING MATERIALS BULK SAMPLED

Homogenous Area (HA)	Building Material	Sample Number(s)	Sample Location(s) (1)
1	Gray Expansion Joint Concrete	856-001-001, 856-001-002	W208 (Corridor)
2	Tan/White/Silver Wrap / HVAC Mastic	856-002-001, 856-002-002, 856-002-003, 856-002-004, 856-002-005, 856-002-006, 856-002-007, 856-002-008	W208 (Corridor), W280 (Corridor), W203, W212, W220
3	2’x4’ White Ceiling Tile (SH/LF)	856-003-001, 856-003-002, 856-003-003	W208 (Corridor), W280 (Corridor), W204
4	12”x12” Red Floor Tile	856-004-001, 856-004-002	W280 (Corridor)
5	12”x12” Blue Floor Tile	856-005-001, 856-005-002	W280 (Corridor)
6	Red BC w/Tan Mastic	856-006-001	W253 (Corridor)
7	12"x12" Tan FT w/Tan Mastic	856-007-001, 856-007-002	W253 (Corridor), W280 (Corridor)
8	12"x12" Black Speck FT w/ Tan Mastic	856-008-001, 856-008-002	W228, W201A
9	Black BC w/ White and Tan Mastic	856-009-001	W228
10	White Joint Compound/Brown Drywall	856-010-001, 856-010-002, 856-010-003, 856-010-004, 856-010-005, 856-010-006	W280 (Corridor), W203, W204, W214, W219, W220
11	Tan HVAC Mastic w/Orange Backing	856-011-001, 856-011-002	W203
12	Gray Mastic Seam AHU-5	856-012-001, 856-012-002	Mechanical Room AHU-5
13	White/Brown Tape / Pipe Mastic	856-013-001, 856-013-002	Mechanical Room AHU-5
14	Gray Mastic Inside AHU-5	856-014-001, 856-014-002	Mechanical Room AHU-5
15	Yellow Insulation	856-015-001, 856-015-002	Mechanical Room AHU-5
16	White Pipe Fitting	856-016-001, 856-016-002	Mechanical Room AHU-5
17	Jacketing on Exterior AHU-5	856-017-001, 856-017-002	Mechanical Room AHU-5
18	Gray Mastic on HVAC Duct	856-018-001, 856-018-002	Mechanical Room AHU-5
19	Yellow Mastic AHU-5	856-019-001, 856-019-002	Mechanical Room AHU-5
20	12"x12" VTF-Black Speck w/Black	856-020-001, 856-020-002, 856-020-003	W203, W219, W225
21	1'x4' Ceiling Tile	856-021-001, 856-021-002	W220
22	CHR Pipe Tape	856-022-001, 856-022-002, 856-022-003	W204, W220
23	12"x12" Tan VFT w/Black Mastic	856-023-001, 856-023-002	W219
24	Gray Fireproofing	856-024-001, 856-024-002, 856-024-003	W220

Notes: Specific sample locations are referenced in Appendix B – Asbestos Sample Location Diagrams.

TABLE 2: LABORATORY CONFIRMED ACM

HA (1)	ACM	Sample Number(s)	Sample Location(s) (1)	Percent Asbestos	EPA NESHAP Category
2	Tan/White/Silver Wrap / HVAC Mastic	856-002-001	W208 (Corridor)	1.1% Chrysotile	Category II
2	Tan/White/Silver Wrap / HVAC Mastic	856-002-002	W208 (Corridor)	1.3% Chrysotile	Category II
2	Tan/White/Silver Wrap / HVAC Mastic	856-002-003	W280 (Corridor)	1.2% Chrysotile	Category II
2	Tan/White/Silver Wrap / HVAC Mastic	856-002-004	W208 (Corridor)	1.3% Chrysotile	Category II
8	12"x12" White w/Black Speck FT	856-008-001	W228	1.1% Chrysotile	Category I
8	12"x12" White w/Black Speck FT	856-008-002	W201	1.5% Chrysotile	Category I
11	Tan HVAC Mastic	856-011-001	W203	1.2% Chrysotile	Category II
11	Tan HVAC Mastic	856-011-002	W203	1.3% Chrysotile	Category II
12	Gray Mastic Seam AHU-5	856-012-001	Mechanical Room AHU-5	1.3% Chrysotile	Category II
12	Gray Mastic Seam AHU-5	856-012-002	Mechanical Room AHU-5	1.1% Chrysotile	Category II
13	White/Brown Tape / Pipe Mastic	856-013-001	Mechanical Room AHU-5	1.1% Chrysotile	Category II
13	White/Brown Tape / Pipe Mastic	856-013-002	Mechanical Room AHU-5	1.2% Chrysotile	Category II
14	Gray Mastic Inside AHU-5	856-014-001	Mechanical Room AHU-5	0.25% Chrysotile	Category II
14	Gray Mastic Inside AHU-5	856-014-002	Mechanical Room AHU-5	0.75% Chrysotile	Category II
17	Jacketing on Exterior AHU-5	856-017-001	Mechanical Room AHU-5	Trace Chrysotile	Category II
17	Jacketing on Exterior AHU-5	856-017-002	Mechanical Room AHU-5	Trace Chrysotile	Category II
19	Yellow Mastic AHU-5	856-019-001	Mechanical Room AHU-5	1.1% Chrysotile	Category II
20	12"x12" VTF-White w/Black Speck w/Black Mastic	856-020-001	W203	2.7% Chrysotile 1.5% Chrysotile	Category I Category II
20	Black Mastic	856-020-002	W219	1.2% Chrysotile	Category II
20	12"x12" VTF- White w/Black Speck w/Black Mastic	856-020-003	W225	3.1% Chrysotile 2.0% Chrysotile	Category I Category II
23	Black Mastic	856-023-001	W219	2.3% Chrysotile	Category II

Notes: Specific sample locations are referenced in Appendix B – Asbestos Sample Location Diagrams.

TABLE 3: NON-ACM

HA	Building Material	HA	Building Material
1	Gray Expansion Joint Concrete	15	Yellow Insulation
3	2’x4’ White Ceiling Tile (SH/LF)	16	White Pipe Fitting
4	12”x12” Red Floor Tile	18	Gray Mastic on HVAC Duct
5	12”x12” Blue Floor Tile	21	1'x4' Ceiling Tile
6	Red BC w/Tan Mastic	22	CHR Pipe Tape
7	12"x12" Tan FT w/Tan Mastic	24	Gray Fireproofing
9	Black BC w/ White and Tan Mastic		
10	White Joint Compound/Brown Drywall		

Legend:				
	HA	Homogenous Area	SH	Small Holes
	LF	Large Fissures	a/w	Associated With
	VAV	Variable Air Volume	SF	Small Fissures
	WF	Wavy Fissures	LH	Large Holes
	CHW	Chilled Water	TEXT	Textured
	DIV	Divided	AHU	Air Handling Unit
	CWR	Chilled Water Return	CWS	Chilled Water Supply
	ACM	Asbestos Containing Material	EPA	Environmental Protection Agency
	NESHAP	National Emissions Standard for Hazardous Air Pollutants	w/	With
	FT	Floor Tile	HVAC	Heating Ventilation Air-Conditioning

APPENDIX D-4

ASBESTOS LABORATORY CERTIFICATES OF ANALYSIS & CHAIN OF CUSTODY

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449 Email: customerservice@iatl.com

Chain of Custody

PLM

Contact Information

Client Company:	Auxano Environmental LLC	**Project Number:**	W1912QR-17-D-0035
Office Address:	516 Heritage Trace	**Project Name:**	AHU 5
City, State, Zip:	Lebanon , OH 45036	**Primary Contact:**	Nicole Lashley
Fax Number:		**Office Phone:**	9372711226
Email Address:	auxanoenvironmental@outlook.com	**Cell Phone:**	9372711226

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *
- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [ ] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer
- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions
- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions:

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: 12/18/2018 5:00:00 PM
Specific date/time

- [x] Email
- [ ] Hard Copy
- [x] Portal
- [ ] Verbal

- [ ] 6 Hour
- [ ] 12 Hour
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 4 Day
- [x] 5 Day

*** End of next business day unless otherwise specified. ** Matrix Dependent. *** Please notify the lab before shipping *****

Chain of Custody

Relinquished (Name/Organization):	Nichole Lashley Auxano Env.	Date: 12/11/18	Time: 3:00pm
Received (Name/iATL):		Date:	Time:
Sample Login (Name/iATL):		Date: 12-15-18	Time:
Analysis (Name(s)/iATL):	12-19-18	Date:	Time:
QA/QC Review (Name/iATL):		Date: 12-26-18	Time:
Archived/Released:	Archived/Released:	Date:	Time:

RECEIVED DEC 15 2018 IATL - BY

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B Mt. Laurel, New Jersey 08054
Telephone: 8562319449 Email: customerservice@iatl.com

Sample Log

Client: Auxano Environmental LLC

Project: W1912QR-17-D-0035 AHU 5

Sample Log				
Client Sample #	**IATL #**	**Location**	**Description**	**Notes**
856-001-001	6674219	Above Ceiling W208 COR	Gray Concrete	
856-001-002	6674220	Above Ceiling W208 COR	Gray Concrete	
856-002-001	6674221	Above Ceiling W208 COR	Tan HVAC Mastic	
856-002-002	6674222	Above Ceiling W208 COR	Tan HVAC Mastic	
856-002-003	6674223	Above Ceiling W280 COR	Tan HVAC Mastic	
856-002-004	6674224	Above Ceiling W280 COR	Tan HVAC Mastic	
856-002-005	6674225	Above Ceiling W203	Tan HVAC Mastic	
856-003-001	6674226	W208 COR	Ceiling Tile	
856-003-002	6674227	W280 COR	Ceiling Tile	
856-004-001	6674228	W280 COR	12"x12" Red Floor Tile	
856-004-002	6674229	W280 COR	12"x12" Red Floor Tile	
856-005-001	6674230	W280 COR	12"x12" Blue Floor Tile	
856-005-002	6674231	W280 COR	12"x12" Blue Floor Tile	
856-006-001	6674232	W253 COR	Red BC w/Tan Mastic	
856-007-001	6674233	W253 COR	12"x12" Tan FT w/Tan Mastic	
856-007-002	6674234	W280 COR	12"x12" Tan FT w/Tan Mastic	
856-008-001	6674235	W228	12"x12" Black Speck FT w/Tan Mastic	
856-008-002	6674236	W201A	12"x12" Black Speck FT w/ Tan Mastic	
856-009-001	6674237	W228	Black BC w/ White and Tan Mastic	

856-010-001	6674238	Above Ceiling W280 COR	White Joint Compound	
856-010-002	6674239	Above Ceiling W203	White Joint Compound	
856-011-001	6674240	Above Ceiling W203	Tan HVAC Mastic w/orange Backing	
856-011-002	6674241	Above Ceiling W203	Tan HVAC Masic w/orange Backing	
856-012-001	6674242	9204	Gray Mastic Seam AHU-5	
856-012-002	6674243	9204	Gray Mastic Seam AHU-5	
856-013-001	6674244	9204	White Pipe Tape	
856-013-002	6674245	9204	White Pipe Tape	
856-014-001	6674246	9204	Gray Mastic Inside AHU-5	
856-014-002	6674247	9204	Gray Mastic Inside AHU-5	
856-015-001	6674248	9204	Insulation Inside AHU-5	
856-015-002	6674249	9204	Insulation Inside AHU-5	
856-016-001	6674250	9204	Pipe Fitting	
856-016-002	6674251	9204	Pipe Fitting	
856-017-001	6674252	9204	Jacketing on Exterior AHU-5	
856-017-002	6674253	9204	Jacketing on Exterior AHU-5	
856-018-001	6674254	9204	Gray Mastic on HVAC Duct	
856-018-002	6674255	9204	Gray Mastic on HVAC Duct	
856-019-001	6674256	9204	Yellow Mastic AHU-5	
856-019-002	6674257	9204	Yellow Mastic AHU-5	

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ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674219
Client No.: 856-001-001
Analyst Observation: Grey Concrete
Client Description: Gray Concrete
Location: Above Ceiling W208 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6674220
Client No.: 856-001-002
Analyst Observation: Grey Concrete
Client Description: Gray Concrete
Location: Above Ceiling W208 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6674221
Client No.: 856-002-001
Analyst Observation: Tan/White/Silver Wrap / Mastic
Client Description: Tan HVAC Mastic
Location: Above Ceiling W208 COR
Facility: Building 856

Percent Asbestos:
PC 1.1 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
30 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
58.9

Lab No.: 6674221(L2)
Client No.: 856-002-001
Analyst Observation: Yellow Insulation
Client Description: Tan HVAC Mastic
Location: Above Ceiling W208 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Lab No.: 6674222
Client No.: 856-002-002
Analyst Observation: Tan/White/Silver Wrap / Mastic
Client Description: Tan HVAC Mastic
Location: Above Ceiling W208 COR
Facility: Building 856

Percent Asbestos:
PC 1.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
25 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
63.7

Lab No.: 6674223
Client No.: 856-002-003
Analyst Observation: Tan/White/Silver Wrap / Mastic
Client Description: Tan HVAC Mastic
Location: Above Ceiling W280 COR
Facility: Building 856

Percent Asbestos:
PC 1.2 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
25 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
63.8

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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Mt. Laurel, New Jersey 08054
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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674223(L2)
Client No.: 856-002-003
Analyst Observation: Yellow Insulation
Client Description: Tan HVAC Mastic
Location: Above Ceiling W280 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Lab No.: 6674224
Client No.: 856-002-004
Analyst Observation: Tan/White/Silver Wrap / Mastic
Client Description: Tan HVAC Mastic
Location: Above Ceiling W280 COR
Facility: Building 856

Percent Asbestos:
PC 1.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
20 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
68.7

Lab No.: 6674224(L2)
Client No.: 856-002-004
Analyst Observation: Pink Insulation
Client Description: Tan HVAC Mastic
Location: Above Ceiling W280 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Lab No.: 6674225
Client No.: 856-002-005
Analyst Observation: Tan/White/Silver Wrap / Mastic
Client Description: Tan HVAC Mastic
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
15 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
80

Lab No.: 6674225(L2)
Client No.: 856-002-005
Analyst Observation: Yellow Insulation
Client Description: Tan HVAC Mastic
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Lab No.: 6674226
Client No.: 856-003-001
Analyst Observation: White/Tan Ceiling Tile
Client Description: Ceiling Tile
Location: W208 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
10 Mineral Wool

Percent Non-Fibrous Material:
40

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674227 **Client No.:** 856-003-002	**Analyst Observation:** White/Tan Ceiling Tile **Client Description:** Ceiling Tile	**Location:** W280 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 60 Cellulose 10 Mineral Wool	Percent Non-Fibrous Material: 30
Lab No.: 6674228 **Client No.:** 856-004-001	**Analyst Observation:** Red Floor Tile **Client Description:** 12"x12" Red Floor Tile	**Location:** W280 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6674229 **Client No.:** 856-004-002	**Analyst Observation:** Red Floor Tile **Client Description:** 12"x12" Red Floor Tile	**Location:** W280 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6674230 **Client No.:** 856-005-001	**Analyst Observation:** Blue Floor Tile **Client Description:** 12"x12" Blue Floor Tile	**Location:** W280 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6674231 **Client No.:** 856-005-002	**Analyst Observation:** Blue Floor Tile **Client Description:** 12"x12" Blue Floor Tile	**Location:** W280 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6674232 **Client No.:** 856-006-001	**Analyst Observation:** Red Cove Base **Client Description:** Red BC w/Tan Mastic	**Location:** W253 COR **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674232(L2) **Analyst Observation:** Tan Mastic **Location:** W253 COR
Client No.: 856-006-001 **Client Description:** Red BC w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674233 **Analyst Observation:** Tan Floor Tile **Location:** W253 COR
Client No.: 856-007-001 **Client Description:** 12"x12" Tan FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674233(L2) **Analyst Observation:** Tan Mastic **Location:** W253 COR
Client No.: 856-007-001 **Client Description:** 12"x12" Tan FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674234 **Analyst Observation:** Tan Floor Tile **Location:** W280 COR
Client No.: 856-007-002 **Client Description:** 12"x12" Tan FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674234(L2) **Analyst Observation:** Tan/Grey Mastic/Leveling Compound **Location:** W280 COR
Client No.: 856-007-002 **Client Description:** 12"x12" Tan FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674235 **Analyst Observation:** Tan/Black Floor Tile **Location:** W228
Client No.: 856-008-001 **Client Description:** 12"x12" Black Speck FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: ***PC 1.1*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.9

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
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Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674235(L2) **Analyst Observation:** Tan Mastic **Location:** W228
Client No.: 856-008-001 **Client Description:** 12"x12" Black Speck FT w/Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674236 **Analyst Observation:** Tan/Black Floor Tile **Location:** W201A
Client No.: 856-008-002 **Client Description:** 12"x12" Black Speck FT w/ Tan Mastic **Facility:** Building 856

Percent Asbestos: ***PC 1.5*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.5

Lab No.: 6674236(L2) **Analyst Observation:** Tan Mastic **Location:** W201A
Client No.: 856-008-002 **Client Description:** 12"x12" Black Speck FT w/ Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674237 **Analyst Observation:** Black Cove Base **Location:** W228
Client No.: 856-009-001 **Client Description:** Black BC w/ White and Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674237(L2) **Analyst Observation:** White/Tan Mastic **Location:** W228
Client No.: 856-009-001 **Client Description:** Black BC w/ White and Tan Mastic **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6674238 **Analyst Observation:** White/Brown Drywall **Location:** Above Ceiling W280 COR
Client No.: 856-010-001 **Client Description:** White Joint Compound **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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Mt. Laurel, New Jersey 08054
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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674238(L2)
Client No.: 856-010-001
Analyst Observation: White Joint Compound
Client Description: White Joint Compound
Location: Above Ceiling W280 COR
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6674239
Client No.: 856-010-002
Analyst Observation: White/Brown Drywall
Client Description: White Joint Compound
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose

Percent Non-Fibrous Material:
90

Lab No.: 6674239(L2)
Client No.: 856-010-002
Analyst Observation: White Joint Compound
Client Description: White Joint Compound
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6674240
Client No.: 856-011-001
Analyst Observation: Tan/White Wrap / Mastic
Client Description: Tan HVAC Mastic w/orange Backing
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
PC 1.2 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
10 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
83.8

Lab No.: 6674240(L2)
Client No.: 856-011-001
Analyst Observation: Orange Insulation
Client Description: Tan HVAC Mastic w/orange Backing
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
98 Mineral Wool

Percent Non-Fibrous Material:
2

Lab No.: 6674241
Client No.: 856-011-002
Analyst Observation: Tan/White Wrap / Mastic
Client Description: Tan HVAC Masic w/orange Backing
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos:
PC 1.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
15 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
78.7

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674241(L2)
Client No.: 856-011-002
Analyst Observation: Orange Insulation
Client Description: Tan HVAC Masic w/orange Backing
Location: Above Ceiling W203
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Mineral Wool
Percent Non-Fibrous Material: None Detected

Lab No.: 6674242
Client No.: 856-012-001
Analyst Observation: Grey Mastic
Client Description: Gray Mastic Seam AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 1.3*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.7

Lab No.: 6674243
Client No.: 856-012-002
Analyst Observation: Grey Mastic
Client Description: Gray Mastic Seam AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 1.1*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.9

Lab No.: 6674244
Client No.: 856-013-001
Analyst Observation: White/Brown Tape / Mastic
Client Description: White Pipe Tape
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 1.1*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 25 Cellulose
Percent Non-Fibrous Material: 73.9

Lab No.: 6674245
Client No.: 856-013-002
Analyst Observation: White/Brown Tape / Mastic
Client Description: White Pipe Tape
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 1.2*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 25 Cellulose
Percent Non-Fibrous Material: 73.8

Lab No.: 6674246
Client No.: 856-014-001
Analyst Observation: Grey Mastic
Client Description: Gray Mastic Inside AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 0.25*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.75

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674247
Client No.: 856-014-002
Analyst Observation: Grey Mastic
Client Description: Gray Mastic Inside AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: ***PC 0.75*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.25

Lab No.: 6674248
Client No.: 856-015-001
Analyst Observation: Yellow Insulation
Client Description: Insulation Inside AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 90 Mineral Wool
Percent Non-Fibrous Material: 10

Lab No.: 6674249
Client No.: 856-015-002
Analyst Observation: Yellow Insulation
Client Description: Insulation Inside AHU-5
Location: 9204
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 90 Mineral Wool
Percent Non-Fibrous Material: 10

Lab No.: 6674250
Client No.: 856-016-001
Analyst Observation: White Wrap
Client Description: Pipe Fitting
Location: 9204
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 50 Fibrous Glass
Percent Non-Fibrous Material: 50

Lab No.: 6674250(L2)
Client No.: 856-016-001
Analyst Observation: Yellow Insulation
Client Description: Pipe Fitting
Location: 9204
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 98 Mineral Wool
Percent Non-Fibrous Material: 2

Lab No.: 6674251
Client No.: 856-016-002
Analyst Observation: White/Tan Wrap
Client Description: Pipe Fitting
Location: 9204
Facility: Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 60 Fibrous Glass
Percent Non-Fibrous Material: 40

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674251(L2) **Analyst Observation:** Yellow Insulation **Location:** 9204
Client No.: 856-016-002 **Client Description:** Pipe Fitting **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 95 Mineral Wool
Percent Non-Fibrous Material: 5

Lab No.: 6674252 **Analyst Observation:** White/Tan Wrap **Location:** 9204
Client No.: 856-017-001 **Client Description:** Jacketing on Exterior AHU-5 **Facility:** Building 856

Percent Asbestos: ***PC Trace*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 60 Fibrous Glass
Percent Non-Fibrous Material: 40

Lab No.: 6674252(L2) **Analyst Observation:** Yellow Insulation **Location:** 9204
Client No.: 856-017-001 **Client Description:** Jacketing on Exterior AHU-5 **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Mineral Wool
Percent Non-Fibrous Material: None Detected

Lab No.: 6674253 **Analyst Observation:** White/Tan Wrap **Location:** 9204
Client No.: 856-017-002 **Client Description:** Jacketing on Exterior AHU-5 **Facility:** Building 856

Percent Asbestos: ***PC Trace*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 65 Fibrous Glass
Percent Non-Fibrous Material: 35

Lab No.: 6674253(L2) **Analyst Observation:** Yellow Insulation **Location:** 9204
Client No.: 856-017-002 **Client Description:** Jacketing on Exterior AHU-5 **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Mineral Wool
Percent Non-Fibrous Material: None Detected

Lab No.: 6674254 **Analyst Observation:** Grey Mastic **Location:** 9204
Client No.: 856-018-001 **Client Description:** Gray Mastic on HVAC Duct **Facility:** Building 856

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6674255 **Client No.:** 856-018-002	**Analyst Observation:** Grey Mastic **Client Description:** Gray Mastic on HVAC Duct	**Location:** 9204 **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6674256 **Client No.:** 856-019-001	**Analyst Observation:** Yellow Mastic **Client Description:** Yellow Mastic AHU-5	**Location:** 9204 **Facility:** Building 856
Percent Asbestos: ***PC 1.1*** *Chrysotile*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 98.9
Lab No.: 6674257 **Client No.:** 856-019-002	**Analyst Observation:** Yellow Insulation **Client Description:** Yellow Mastic AHU-5	**Location:** 9204 **Facility:** Building 856
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 95 Mineral Wool	Percent Non-Fibrous Material: 5

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/15/2018
Date Analyzed: 12/19/2018
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Appendix to Analytical Report

Customer Contact: Nicole Lashley
Method: US EPA 600, R93-116

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager: cdavis@iatl.com
iATL Account Representative: Shirley Clark
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	12/19/2018
	4222 Lantana Dr.	Report No.:	579601 - PLM
	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

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Chain of Custody

PLM

Contact Information

Client Company:	Auxano Environmental LLC	**Project Number:**	W1912QR-17-D-0035
Office Address:	4222 Lantana Dr.	**Project Name:**	AHU-5
City, State, Zip:	Lebanon, OH 45036	**Primary Contact:**	Nicole Lashley
Fax Number:		**Office Phone:**	9372711226
Email Address:	auxanoenvironmental@outlook.com	**Cell Phone:**	9372711226

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *
- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [ ] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer
- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions
- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions:

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: 1/3/2019 5:00:00 PM
Specific date/time

- [x] Email
- [ ] Hard Copy
- [x] Portal
- [ ] Verbal

- [ ] 6 Hour
- [ ] 12 Hour
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 4 Day
- [x] 5 Day

*** End of next business day unless otherwise specified. ** Matrix Dependent. *** Please notify the lab before shipping *****

Chain of Custody

Relinquished (Name/Organization):	Nicholle Lashley Auxano Env.	Date:	12/21/18	Time:	3:00 pm
Received (Name/iATL):		Date:		Time:	
Sample Login (Name/iATL):		Date:		Time:	
Analysis (Name(s)/iATL):		Date:		Time:	DEC 28
QA/QC Review (Name/iATL):		Date:	1-3-19	Time:	
Archived/Released:	Archived/Released:	Date:		Time:	

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Telephone: 8562319449 Email: customerservice@iatl.com

Sample Log

Client: Auxano Environmental LLC

Project: W1912QR-17-D-0035 AHU-5

Sample Log

Client Sample #	IATL #	Location	Description	Notes
856-002-006	6681301	Room W212	Tan HVAC Mastic	
856-002-007	6681302	Room W220	Tan HVAC Mastic	
856-002-008	6681303	Room W220	Tan HVAC Mastic	
856-010-003	6681304	Room W204	Joint Compound w/wall board	
856-010-004	6681305	Room W219	Joint Compound w/wall board	
856-010-005	6681306	Room W220	Joint Compound w/wall board	
856-003-003	6681307	Room W204	Ceiling Tile	
856-020-001	6681308	Room W203	12"x12" VTF-Black speck w/Black Mastic	
856-020-002	6681309	Room W219	12"x12" VFT-Black speck w/Black Mastic	
856-020-003	6681310	Room W225	12"x12" VTF-Black speck w/Black Mastic	
856-021-001	6681311	Room W220	1'x4' Ceiling Tile	
856-021-002	6681312	Room W220	1'x4' Ceiling Tile	
856-022-001	6681313	Room W204	CHR Pipe Tape	
856-022-002	6681314	Room W204	CHR Pipe Tape	
856-022-003	6681315	Room W220	CHR Pipe Tape	
856-023-001	6681316	Room W219	12"x12" Tan VFT w/Black Mastic	
856-023-002	6681317	Room W219	12"x12" Tan VTF w/Black Mastic	
856-024-001	6681318	Room W220	Fire Proofing	
856-024-002	6681319	Room W220	Fire Proofing	
856-024-003	6681320	Room W220	Fire Proofing	

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
Client:	AUX916	Project No.:	W1912QR-17-D-0035

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6681301
Client No.: 856-002-006
Analyst Observation: Tan Mastic
Client Description: Tan HVAC Mastic
Location: Building 856-Room W212
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6681302
Client No.: 856-002-007
Analyst Observation: Tan Mastic
Client Description: Tan HVAC Mastic
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6681303
Client No.: 856-002-008
Analyst Observation: Tan Mastic
Client Description: Tan HVAC Mastic
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6681304
Client No.: 856-010-003
Analyst Observation: White Drywall
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W204
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6681304(L2)
Client No.: 856-010-003
Analyst Observation: White Joint Compound
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W204
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6681305
Client No.: 856-010-004
Analyst Observation: White Drywall
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W219
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Erik Swanson

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
Client:	AUX916	Project No.:	W1912QR-17-D-0035

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6681305(L2)
Client No.: 856-010-004
Analyst Observation: White Joint Compound
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W219
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6681306
Client No.: 856-010-005
Analyst Observation: White Drywall
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6681306(L2)
Client No.: 856-010-005
Analyst Observation: White Joint Compound
Client Description: Joint Compound w/Wallboard
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6681307
Client No.: 856-003-003
Analyst Observation: Beige Ceiling Tile
Client Description: Ceiling Tile
Location: Building 856-Room W204
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
15 Fibrous Glass

Percent Non-Fibrous Material:
45

Lab No.: 6681308
Client No.: 856-020-001
Analyst Observation: Tan Floor Tile
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W203
Facility:

Percent Asbestos:
PC 2.7 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
97.3

Lab No.: 6681308(L2)
Client No.: 856-020-001
Analyst Observation: Green Mastic
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W203
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Erik Swanson

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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Mt. Laurel, New Jersey 08054
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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6681308(L3)
Client No.: 856-020-001
Analyst Observation: Black Mastic
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W203
Facility:

Percent Asbestos:
PC 1.5 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.5

Lab No.: 6681309
Client No.: 856-020-002
Analyst Observation: White Floor Tile
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W219
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6681309(L2)
Client No.: 856-020-002
Analyst Observation: Black Mastic
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W219
Facility:

Percent Asbestos:
PC 1.2 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.8

Lab No.: 6681310
Client No.: 856-020-003
Analyst Observation: White Floor Tile
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W225
Facility:

Percent Asbestos:
PC 3.1 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
96.9

Lab No.: 6681310(L2)
Client No.: 856-020-003
Analyst Observation: Black Mastic
Client Description: 12"x12" VTF-Black Speck w/Black Mastic
Location: Building 856-Room W225
Facility:

Percent Asbestos:
PC 2.0 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98

Lab No.: 6681311
Client No.: 856-021-001
Analyst Observation: Beige Ceiling Tile
Client Description: 1'x4' Ceiling Tile
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
15 Fibrous Glass

Percent Non-Fibrous Material:
45

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Erik Swanson

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6681312 **Client No.:** 856-021-002	**Analyst Observation:** Beige Ceiling Tile **Client Description:** 1'x4' Ceiling Tile	**Location:** Building 856-Room W220 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 40 Cellulose 15 Fibrous Glass	Percent Non-Fibrous Material: 45
Lab No.: 6681313 **Client No.:** 856-022-001	**Analyst Observation:** Tan/Silver Tape **Client Description:** CHR Pipe Tape	**Location:** Building 856-Room W204 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 10 Cellulose 5 Fibrous Glass	Percent Non-Fibrous Material: 85
Lab No.: 6681314 **Client No.:** 856-022-002	**Analyst Observation:** Tan/Silver Tape **Client Description:** CHR Pipe Tape	**Location:** Building 856-Room W204 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 10 Cellulose 5 Fibrous Glass	Percent Non-Fibrous Material: 85
Lab No.: 6681315 **Client No.:** 856-022-003	**Analyst Observation:** White/Tan Tape **Client Description:** CHR Pipe Tape	**Location:** Building 856-Room W220 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: 50 Fibrous Glass	Percent Non-Fibrous Material: 50
Lab No.: 6681316 **Client No.:** 856-023-001	**Analyst Observation:** White Floor Tile **Client Description:** 12"x12" Tan VFT w/Black Mastic	**Location:** Building 856-Room W219 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100
Lab No.: 6681317 **Client No.:** 856-023-002	**Analyst Observation:** White Floor Tile **Client Description:** 12"x12" Tan VTF w/Black Mastic	**Location:** Building 856-Room W219 **Facility:**
Percent Asbestos: *None Detected*	Percent Non-Asbestos Fibrous Material: None Detected	Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Erik Swanson

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
Client:	AUX916	Project No.:	W1912QR-17-D-0035

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6681317(L2)
Client No.: 856-023-002
Analyst Observation: Black Mastic
Client Description: 12"x12" Tan VTF w/Black Mastic
Location: Building 856-Room W219
Facility:

Percent Asbestos:
PC 2.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
97.7

Lab No.: 6681318
Client No.: 856-024-001
Analyst Observation: Grey Insulation
Client Description: Fireproofing
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
95 Fibrous Glass

Percent Non-Fibrous Material:
5

Lab No.: 6681319
Client No.: 856-024-002
Analyst Observation: Grey Insulation
Client Description: Fireproofing
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
95 Fibrous Glass

Percent Non-Fibrous Material:
5

Lab No.: 6681320
Client No.: 856-024-003
Analyst Observation: Grey Insulation
Client Description: Fireproofing
Location: Building 856-Room W220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
95 Fibrous Glass

Percent Non-Fibrous Material:
5

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Erik Swanson

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Appendix to Analytical Report

Customer Contact: Nicole Lashley
Method: US EPA 600, R93-116

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager: cdavis@iatl.com
iATL Account Representative: Shirley Clark
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580322 - PLM
	Lebanon OH 45036	Project:	AHU-5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

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Telephone: 856-231-9449 Email: customerservice@iatl.com

Chain of Custody

PLM

Contact Information

Client Company: Auxano Environmental LLC
Office Address: 4222 Lantana Dr.
City, State, Zip: Lebanon, OH 45036
Fax Number:
Email Address: auxanoenvironmental@outlook.com

Project Number: W1912QR-17-D-0035
Project Name: Building 856
Primary Contact: Nicole Lashley
Office Phone: 9372711226
Cell Phone: 9372711226

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *
- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [ ] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer
- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions
- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions:

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: 1/11/2019 5:00:00 PM
Specific date/time

- [x] Email
- [ ] Hard Copy
- [x] Portal
- [ ] Verbal

- [ ] 6 Hour
- [ ] 12 Hour
- [ ] 1 Day
- [ ] 2 Day
- [ ] 3 Day
- [ ] 4 Day
- [x] 5 Day

*** End of next business day unless otherwise specified. ** Matrix Dependent. *** Please notify the lab before shipping *****

Chain of Custody

Relinquished (Name/Organization):	Nicole Lashley Auxano Env.	Date:	1/4/19	Time:	10:45 am
Received (Name/iATL):		Date:		Time:	
Sample Login (Name/iATL):		Date:		Time:	
Analysis (Name(s)/iATL):		Date:	1/10/19	Time:	
QA/QC Review (Name/iATL):		Date:	1-11-19	Time:	JAN 2019
Archived/Released:	Archived/Released:	Date:		Time:	

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9000 Commerce Parkway Suite B Mt. Laurel, New Jersey 08054
Telephone: 8562319449 Email: customerservice@iatl.com

Sample Log

Client: Auxano Environmental LLC

Project: W1912QR-17-D-0035 Building 856

Sample Log				
Client Sample #	**IATL #**	**Location**	**Description**	**Notes**
856-010-006	6686392	Room 214	Drywall Joint Compound	

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/10/2019
	4222 Lantana Dr.	Report No.:	580836 - PLM
	Lebanon OH 45036	Project:	Building 856
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6686392
Client No.: 856-010-006

Analyst Observation: White Joint Compound
Client Description: Drywall Joint Compound

Location: Room 214
Facility: Building 856

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 1/7/2019
Date Analyzed: 01/10/2019
Signature:
Analyst: Randy Caran

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/10/2019
	4222 Lantana Dr.	Report No.:	580836 - PLM
	Lebanon OH 45036	Project:	Building 856
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Appendix to Analytical Report

Customer Contact: Nicole Lashley
Method: US EPA 600, R93-116

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager: cdavis@iatl.com
iATL Account Representative: Shirley Clark
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/10/2019
	4222 Lantana Dr.	Report No.:	580836 - PLM
	Lebanon OH 45036	Project:	Building 856
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

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Chain of Custody

Mold

Contact Information

Client Company: Auxano Environmental LLC
Office Address: 4222 Lantana Dr.
City, State, Zip: Lebanon, OH 45036
Fax Number:
Email Address: auxanoenvironmental@outlook.com

Project Number: W1912QR-17-D-0035
Project Name: AHU 5
Primary Contact: Nicole Lashley
Office Phone: 9372711226
Cell Phone: 9372711226

Mold Analytical Services/ Special Instructions

☐ **Non-Culturable:**

☐ Mold /Bioaersol Fungal Spore Trap:
Proprietary Method for Airborne Fungal Spore Identification/Quantitation Zefon Air-O-CellTM, or Air-O-Cell-like cassette (ex. AllergencoTM, Micro5TM, etc.)

☐ Mold/Tape, Swab, Bulk:
Proprietary Method for Direct Transfer Fungal Spore Identification Zefon Bio-TapeTM, other transparent cellophane tape

☐ Mold/Miscellaneous:
Proprietary Method for Fungal Spore Identification in Carpets, Dusts, Surfaces Micro-Vacuum Cassettes, Carpet samples, etc. (ex. AIHA Vol. 64, No. 6, 11/2003)

☐ **Culturable:**

☐ Mold/Bioaersol Fungal Contact Plate (Qualitative Only):
Proprietary Method for Airborne Fungal Spore Identification (non-quantifiable) AndersonTM Plates, Bio-CassetteTM Surface Air Sampler, or aersol impacted growth medium

☐ Mold/Bioaersol Fungal Contact Plate (Qualitative and Quantifiable):
Proprietary Method for Airborne Fungal Spore Identification (Quantifiable in CFU) AndersonTM Plates, Bio-CassetteTM, or aersol impacted growth medium

☑ Mold/Swab, Bulk:
Proprietary Method for Growth and Identification of Fungal Spores Sealable/Sterile Swab, Bulk, (Call lab for availability)

☐ Mold/Miscellaneous:
Proprietary Method for Growth and ID of Fungal Spores in Carpets, Dusts, Surfaces Micro-Vacuum Cassettes, Carpet samples, etc. (ex. AIHA Vol. 64, No. 6, 11/2003)

Turnaround Time

Preliminary Results Requested Date: 1/3/2019 5:00:00 PM
Specific date/time

☑ Email ☐ Hard Copy ☑ Portal ☐ Verbal

☐ 6 Hour ☐ 12 Hour ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 4 Day ☑ 5 Day

*** End of next business day unless otherwise specified. ** Matrix Dependent. *** Please notify the lab before shipping *****

Chain of Custody

Relinquished (Name/Organization):	Nicole Lashley Auxano Env.	Date:	12/21/18	Time:	3:00pm
Received (Name/iATL):		Date:		Time:	
Sample Login (Name/iATL):		Date:		Time:	
Analysis (Name(s)/iATL):		Date:	1/2/19	Time:	
QA/QC Review (Name/iATL):		Date:	1-4-19	Time:	
Archived/Released:	Archived/Released:	Date:		Time:	

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Sample Log

Mold

Client: Auxano Environmental LLC

Project: W1912QR-17-D-0035,AHU 5

Sample Log					
Client Sample #	**IATL #**	**Location**	**Description[1]**	**Notes[2]**	**Sample Volume/Area**
Mold #1	6680648	Room W220	Bulk Swab		2cm2
Mold #2	6680649	Room W220	Bulk Swab		2cm2

[1]Description includes sample matrix. Location should include genera area of country

Matrix:

Location:

[2]Evaluation of Mold/Fungal spore samples may be aided by detailed observations and documentation of sampling conditions.

Weather: Overcast

Temperature: 70°

Relative Humidity:

RH Area/General:

Date/Time: 12/20/18

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CERTIFICATE OF ANALYSIS

Client:	Auxano Environmental LLC	Report Date:	1/2/2019
	4222 Lantana Dr.	Report No.:	580283 - Mold Direct Transfer
	Lebanon OH 45036	Project:	AHU 5
Client:	AUX916	Project No.:	W1912QR-17-D-0035

DIRECT TRANSFER MOLD SPORE SAMPLE ANALYSIS SUMMARY

Lab No.: 6680648
Client No.: Mold #1
Location: Room W220
Description: Bulk Swab
Sample Type: Swab
Loading: -
Genera:
None Detected

Lab No.: 6680649
Client No.: Mold #2
Location: Room W220
Description: Bulk Swab
Sample Type: Swab
Loading: High
Genera:
Epicoccum

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 12/26/2018
Date Analyzed: 01/02/2019
Signature:
Analyst: Ben Reich

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

Dated : 1/4/2019 9:55:49

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	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

Appendix to Analytical Report:

Customer Contact: Nicole Lashley
Analysis: IAQL 061804, Based upon ASTM D7910 -Standard Practice for Collection of Fungal Material From Surfaces by Tape Lift

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager: cdavis@iatl.com
iATL Account Representative: Shirley Clark
Sample Matrix: Tape, Swab, Bulk
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

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Information Pertinent to this Report:

Analysis by IAQL 061804

Certification: EMLAP AIHA-LAP, LLC No. 100188

All results are based on the samples as received at the lab. iATl assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Results include genera of mold observed and their prevalence with respect to the Tape lift provided or produced for analysis. Only the three most prevalent Genera / Species are reported at levels:

High = Most of the observed debris on the tape or swab is comprised of mold spores / hyphae, generally considered to be >10% loading

Med = Some of the observed debris on the tape or swab is comprised of mold spores / hyphae, generally considered to be 1-10% loading

Low = Very little of the observed debris on the tape or swab is comprised of mold spores / hyphae, generally considered to be <1% loading

Reported alone, 'Hyphae' indicates mold growth, but not discernible spores.

It is the responsibility of the client to supply a tape lift, swab, or bulk material which is representative of the area being evaluated. The absence or presence of mold on a surface sample is limited by the specific location of the sample, the number of samples taken relative to the area being evaluated, as well as the sampling technique

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	Lebanon OH 45036	Project:	AHU 5
		Project No.:	W1912QR-17-D-0035
Client:	AUX916		

employed.

The use of Non-Transparent tape requires that a tape lift be taken by the lab from the client submittal, which may impact results.

Interpretation of these results is left to the company / person who sampled or inspected the location to be tested. All biological samples have inherent variability.

IATL utilizes 1000X magnification (oil) to perform qualitative analysis.

Disclaimers / Qualifiers:

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APPENDIX E-5

INVENTORY OF ACM

INVENTORY OF ASBESTOS CONTAINING MATERIALS
Wright Patterson Air Force Base
856 - Replace AHU-5

Air-Handling Unit (AHU)	Functional Space	Homogeneous Area	Asbestos Containing Materials (ACM)	ACM Quantity (1)	Component Quantity (ACM and non-ACM)	Condition	Confirmed / Assumed	NEHSAP Category (2)	Photo Reference (Appendix F)	Anticipated To Be Impacted Via Renovation Requiring Abatement?
5										
	W208	2	White/Tan Adhesive on Duct Insulation	175 sf	1050 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	Black Mastic a/w 12" x 12" Grey / Brown / Tan Floor Tile	388 sf	N/A	Intact	Confirmed	Category II	-----	(4)
			White Adhesive on VAV Boxes	4 sf	80 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Boxes	0.50 sf		Intact	Assumed	Category II	-----	(3)
	W201 & W201A	2	White/Tan Adhesive on Duct Insulation	10 sf	60 sf	Intact	Confirmed	Category II	-----	(3)
	W202 & W202A	2	White/Tan Adhesive on Duct Insulation	10 sf	60 sf	Intact	Confirmed	Category II	-----	(3)
	W202B		Undercoating on Janitors Sink	2 sf	N/A	Intact	Assumed	Category II	-----	(4)
	W203		White Adhesive on VAV Boxes	4 sf	80 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Boxes	0.50 sf		Intact	Assumed	Category II	-----	(3)
		2	White/Tan Adhesive on Duct Insulation	80 sf	480 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	398 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
	W203A		White Adhesive on VAV Boxes	4 sf	80 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Boxes	0.50 sf		Intact	Assumed	Category II	-----	(3)
		2	White/Tan Adhesive on Duct Insulation	80 sf	480 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	1,600 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
	W203B	2	White/Tan Adhesive on Duct Insulation	7 sf	42 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	280 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	27 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W203C	2	White/Tan Adhesive on Duct Insulation	4 sf	24 sf	Intact	Confirmed	Category II		(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	100 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
			White Adhesive on VAV Box	2 sf	27 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W203D	2	White/Tan Adhesive on Duct Insulation	13 sf	78 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
			White Adhesive on VAV Box	4 sf	50 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.5 sf		Intact	Assumed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	200 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
	W203E	2	White/Tan Adhesive on Duct Insulation	13 sf	78 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
			White Adhesive on VAV Box	4 sf	50 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.5 sf		Intact	Assumed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	200 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
	W203F	2	White/Tan Adhesive on Duct Insulation	4 sf	24 sf	Intact	Confirmed	Category II		(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	100 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
			White Adhesive on VAV Box	2 sf	27 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W204	2	White/Tan Adhesive on Duct Insulation	22 sf	132 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
			White Adhesive on VAV Box	4 sf	50 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.5 sf		Intact	Assumed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	200 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
	W209	2	White/Tan Adhesive on Duct Insulation	120 sf	720 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
			White Adhesive on VAV Box	4 sf	50 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.5 sf		Intact	Assumed	Category II	-----	(3)
	W210		White Adhesive on VAV Box	2 sf	50 sf	Intact	Confirmed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Confirmed	Category II	-----	(3)
		2	White/Tan Adhesive on Duct Insulation	5 sf	30 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	80 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W214 & W214A		White Adhesive on VAV Box	3 sf	75 sf	Intact	Confirmed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.5 sf		Intact	Confirmed	Category II	-----	(3)
		2	White/Tan Adhesive on Duct Insulation	223 sf	1338 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	2100 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W219	2	White/Tan Adhesive on Duct Insulation	8 sf	48 sf	Intact	Confirmed	Category II		(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic	100 sf	N/A	Intact	Confirmed	Category I / Category II		(4)
			White Adhesive on VAV Box	2 sf	27 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220	-----	Fire Doors	2 each	N/A	Intact	Assumed	Category II	-----	(4)
			White Adhesive on VAV Boxes	20 sf	400 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Boxes	4 sf		Intact	Assumed	Category II	-----	(3)
		2	White/Tan Adhesive on Duct Insulation	978 sf	5868 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	12" x 12" White w/ Black Specks VTF / Black Mastic (Beneath Carpet & Greene Mastic	19,600 sf (7)	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
	W220A	2	White/Tan Adhesive on Duct Insulation	8 sf	24 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	16 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220B	2	White/Tan Adhesive on Duct Insulation	16 sf	96 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	24 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220C	2	White/Tan Adhesive on Duct Insulation	8 sf	48 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	16 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)

INVENTORY OF ASBESTOS CONTAINING MATERIALS
Wright Patterson Air Force Base
856 - Replace AHU-5

W912QR23R0022_CUI_Specs-0000

Air-Handling Unit (AHU)	Functional Space	Homogeneous Area	Asbestos Containing Materials (ACM)	ACM Quantity (1)	Component Quantity (ACM and non-ACM)	Condition	Confirmed / Assumed	NEHSAP Category (2)	Photo Reference (Appendix F)	Anticipated To Be Impacted Via Renovation Requiring Abatement?
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220D	2	White/Tan Adhesive on Duct Insulation	8 sf	48 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	16 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220E	2	White/Tan Adhesive on Duct Insulation	15 sf	90 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	200 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W220F	2	White/Tan Adhesive on Duct Insulation	15 sf	90 sf	Intact	Confirmed	Category II	-----	(3)
		8, 20, 23	2" x 12" White w/ Black Specks Floor Tile / Black Mastic (Beneath Carpet & Tan Masti	200 sf	N/A	Intact	Confirmed	Category I / Category II	-----	(4)
			White Adhesive on VAV Box	2 sf	30 sf	Intact	Assumed	Category II	-----	(3)
			Grey Caulk on VAV Box	0.25 sf		Intact	Assumed	Category II	-----	(3)
	W225A	2	White/Tan Adhesive on Duct Insulation	3 sf	18 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Transite Contact Switches Associated With Electrical Panels	4 Panels (20 sf total)	-----	Unknown	Assumed	Cateogry II	-----	(4)
		8, 20, 23	Black Mastic a/w 12" x 12" Grey / Brown / Tan Floor Tile	24 sf	N/A	Intact	Confirmed	Category II	-----	(4)
	W226 & W226A	2	White/Tan Adhesive on Duct Insulation	10 sf	60 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W227	2	White/Tan Adhesive on Duct Insulation	10 sf	60 sf	Intact	Confirmed	Category II	-----	(3)
		-----	Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W228		Undercoating on Janitors Sink	2 sf	N/A	Intact	Assumed	Category II	-----	(4)
			Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W298		Fire Door	1 each	N/A	Intact	Assumed	Category II	-----	(4)
	W299		Gaskets a/w Flanges and Valves a/w AHU #5	10 sf	18 each	Unknown	Assumed	Category I	-----	(3)
			Vibration Cloth	10 sf	N/A	Intact	Assumed	Category II	-----	(3)
		13	CWR / CWS Pipe Insulation White Sealant a/w AHU #5	5 fittings/ 36 lf	120 lf	35% Significantly Damaged	Confirmed	Category II	-----	(3)
		12	Gray Mastic Seem AHU #5	25 sf	Not Quantified	Intact	Confirmed	Category II	-----	(3)
		19	Yellow Mastic Transition AHU #5	15 sf	N/A	Intact	Confirmed	Category II	-----	(3)
		17	White Jaketing AHU #5	1,300 sf	Not Quantified	Intact	Confirmed	Category II	-----	(3)
		-----	Black Roofing Tar	400	N/A	Intact	Assumed	Category II		(3)
		-----	Transite Contact Switches a/w Electrical Panels (AHU-5)	2 Panels (100 sf total)	N/A	Intact	Confirmed	Category II	-----	(3)

Notes:

1 Quantity of ACM estimated based upon assessor's understanding of scope of work is not necessarily inclusive of all ACM Homogenous Area quantities throughout the entire functional space.

2 **NESHAP** - National Emissions Standard for Hazardous Air Pollutants

Category I Non-Friable ACM - any asbestos-containing packing, gasket, resilient floor covering or asphalt roofing product which contains more than 1% asbestos as determined using PLM according to the method specified in Appendix A, Subpart F, 40 CFR Part 763 (Section 61.141)

Category II Non-Friable ACM - any material, excluding Category I Non-Friable ACM, containing more than 1% asbestos as determined using PLM according to the method specified in Appendix A, Subpart F, 40 CFR Part 763 (Section 61.141), that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

3 Scope of work directly impacts ACM; abatement of ACM must occur prior to impact or disturbance via renovation work practices (ACM removal is included within scope of work and cost estimate).

4 Scope of work does not appear to require removal of ACM; however, Contractors performing renovation work within the area should be made aware of the presence and locations of these ACM (ACM removal is not included within scope of work and cost estimate).

5 Scope of work does not directly require removal of ACM; however, based upon renovation work occurring ACM should be abated to eliminate any potential disturbance and exposure to ACM during renovation work practices (ACM removal is included within scope of work and cost estimate).

6 Quantity of component includes removal of VAV Box, which contains ACM White Adhesive and ACM Grey Caulk.

7 ACM Floor Tile and Mastic may be present beneath walls and was not included within the quantity listed for this ACM. Asbestos Abatement Contrator should account for this material being present and remove this materials accordingly in selected areas where walls are scheduled for removal. Walls scheduled for demolition should be removed by the Asbestos Abatement Contractor in the event that walls can not be demolished without disturbing any underlying presumed ACM Flooring Materials. Quantity for this ACM is listed separately on this table as "Wall Partition Demolition Areas".

8 Material contains less than 1% asbestos and is not considered an ACM per OSHA and EPA definitions; however, is a material still regulated by OSHA because it contains asbestos content.

LEGEND:

AHU	Air Handling Unit
ACM	Asbestos Containing Material
NAD	No Asbestos Detected
A/W	Associated With
SF	Square Feet
LF	Linear Feet
VAV	Variable Air Volume
AHU	Air Handling Unit
CWR	Chilled Water Return
CWS	Chilled Water Supply
CHW	Chilled Water
DCW	Domestic Cold Water
DHW	Domestic Hot Water
VTF	Vinyl Floor Tile

HAZARDOUS MATERIALS INVENTORY

HAZARDOUS BUILDING MATERIAL INVENTORY REPORT
WRIGHT PATTERSON AIR FORCE BASE
RENOVATION AHU#5 BUILDING 10856

Room	Mercury-Fluorescent Lamps	Incandescent Bulb	High Intensity Discharge Bulbs	Thermostats	Nuclear Fire Sensors	Battery Backup	Non-PCB Light Ballast	Electrical Panels
W201	8			1			4	
W201A	4						2	
W202	8			1			4	
W202A	4						2	
W202B	2						1	
W203	24		2	1		1	12	
W203A	38		2	1		1	19	
W203B	8			1			4	
W203C	10						5	
W203D	12			1			6	
W203E	12			1			6	
W204	12						6	
W208	20						10	
W209	78			1			26	
W210	8			1			4	
W212	12						6	
W214	40			1			20	
W214A	24						12	
W219	8						4	
W220	570		2	6		1	257	
W220A	8						4	
W220B	12						6	
W220C	2						1	
W220D	2						1	
W220E	28		2			1	14	
W220F	24						14	
W225A	12						6	5
W226	2						1	
W226A	12			1			6	
W227	12			1			6	
W228	4						2	
W280	44			1			22	
W298	72		2		12	1	24	
W299	12						6	1
Total:	**1148**	**0**	**10**	**19**	**12**	**5**	**523**	**6**

APPENDIX F-6

PHOTOGRAPH DOCUMENTATION

AHU #5 Building 856 Area A Photograph Documentation

Photo #1	
Date: 6/17/2019	
Location: Room W210	
Description: **Confirmed ACM White/Tan Adhesive on Duct Insulation.**	

Photo #2	
Date: 6/17/2019	
Location: Room W225A	
Description: **Assumed ACM transite panel behind switches.**	

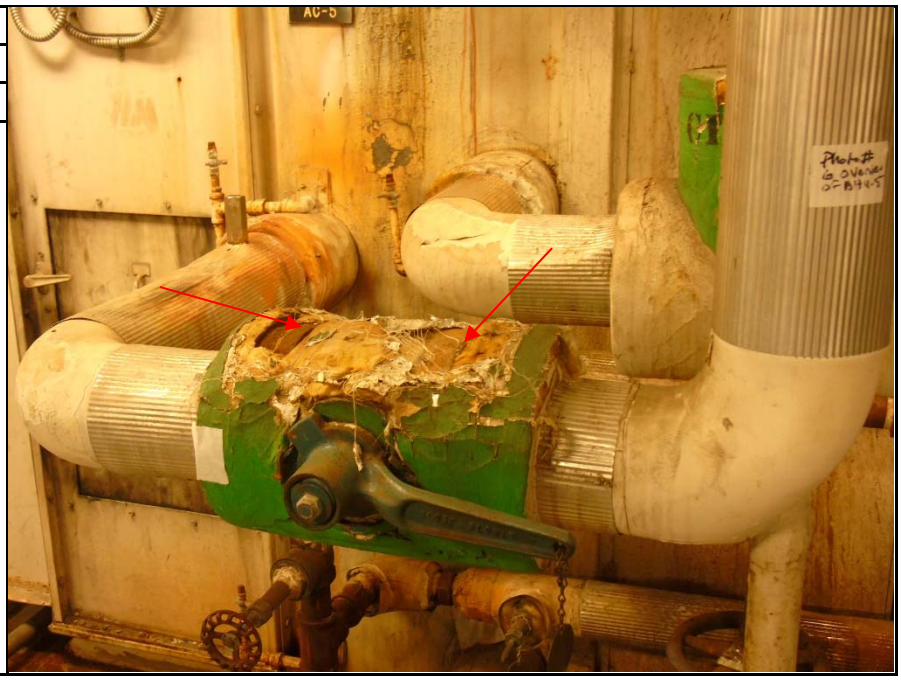
AHU #5 Building 856 Area A
Photograph Documentation

Photo #3	
Date: 6/17/2019	
Location: Room W219	
Description: Confirmed ACM on the VAV box and White/Tan Adhesive on Duct Insulation.	

Photo #4	
Date: 6/17/2019	
Location: Room W202B	
Description: Assumed ACM on underside of sink in the janitor's closet.	

AHU #5 Building 856 Area A
Photograph Documentation

Photo #5	
Date: 6/17/2019	
Location: W 208 COR	
Description: Confirmed ACM White/Tan Adhesive on Duct Insulation.	

Photo #6	
Date: 6/17/2019	
Location: AHU #5	
Description: Assumed ACM gaskets associated with the valve.	

AHU #5 Building 856 Area A
Photograph Documentation

Photo #7	
Date: 6/17/2019	
Location: AHU #5	
Description: **Confirmed ACM Gray Mastic on seem of AHU #5 and assumed ACM vibration cloth.**	

Photo #8	
Date: 6/17/2019	
Location: AHU #5	
Description: **Confirmed ACM Gray Mastic inside of AHU #5.**	

AHU #5 Building 856 Area A Photograph Documentation

Photo #9	
Date: 6/17/2019	
Location: AHU #5	
Description: **Confirmed ACM yellow transition Mastic on seem of AHU #5 and white jacketing on exterior of AHU #5.**	

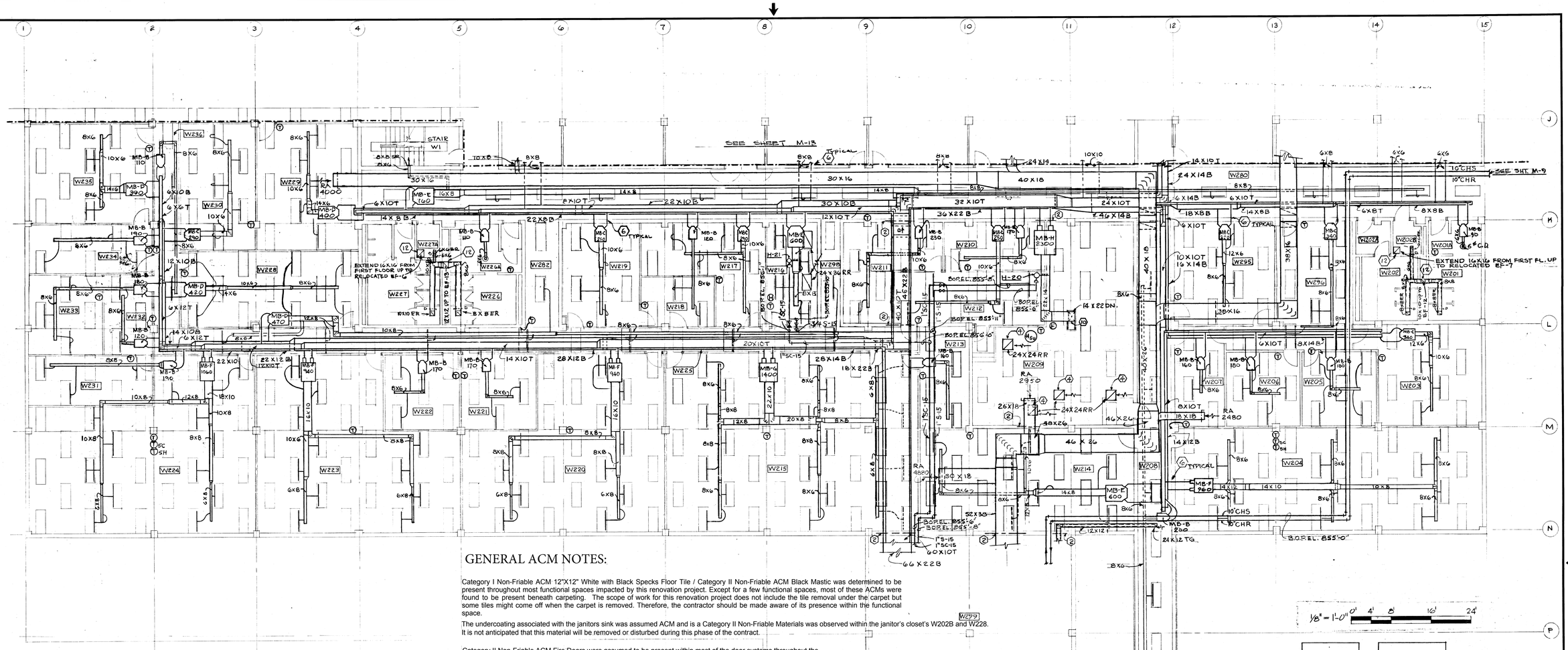
Photo #10	
Date: 6/17/2019	
Location: AHU #5	
Description: **Assumed ACM transite panel associated with AHU #5.**	

AHU #5 Building 856 Area A
Photograph Documentation

Photo #11	
Date: 6/17/2019	
Location: Roof	
Description: Assumed ACM roofing systems.	

APPENDIX G-7

ASBESTOS LOCATIONS

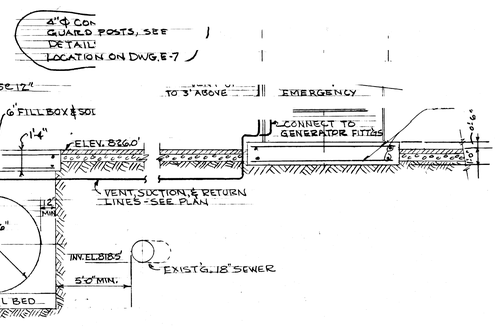


GENERAL ACM NOTES:

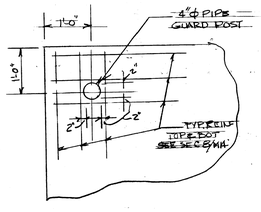
Category I Non-Friable ACM 12"X12" White with Black Specks Floor Tile / Category II Non-Friable ACM Black Mastic was determined to be present throughout most functional spaces impacted by this renovation project. Except for a few functional spaces, most of these ACMs were found to be present beneath carpeting. The scope of work for this renovation project does not include the tile removal under the carpet but some tiles might come off when the carpet is removed. Therefore, the contractor should be made aware of its presence within the functional space.

The undercoating associated with the janitors sink was assumed ACM and is a Category II Non-Friable Materials was observed within the janitor's closet's W202B and W228. It is not anticipated that this material will be removed or disturbed during this phase of the contract.

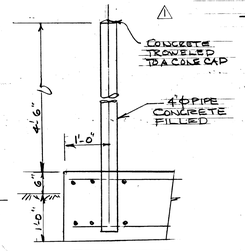
Category II Non-Friable ACM Fire Doors were assumed to be present within most of the door systems throughout the renovation areas. Fire doors were assumed to contain ACM since sampling of the fire doors would entail destructive methods that would destroy the integrity of the door and corresponding fire rating. It is not anticipated that the doors will be part of the renovation process.



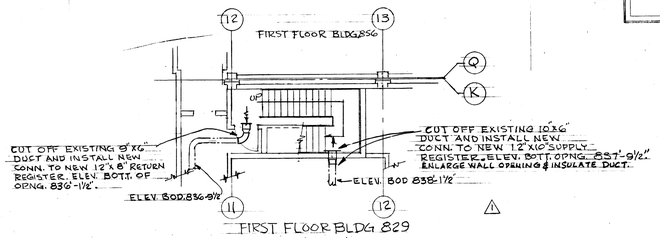
SECTION 8 (E7/M14)
SCALE: 1/4" = 1'-0"



GUARD POST LOCATION PLAN
N.W. CORNER OF EMERGENCY GENERATOR PAD. POST IN N.E. CORNER SIMILARLY LOCATED.
SCALE 3/4" = 1'-0"



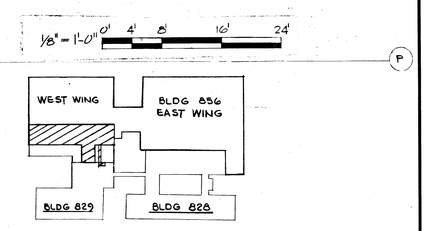
ELEVATION GUARD POST



FIRST FLOOR BLDG 829
SCALE: 1/8" = 1'-0"

Approximately 1,849 square feet of Category II Non-Friable ACM White/Tan Adhesive on Duct Insulation was determined to be present on most of the duct throughout the renovation areas. Some of the functional spaces had appeared to have been renovated such as W298 (where no ducting was found); therefore, this ACM was not observed to be present within this room. In general, most of the ACM White/Tan Adhesive on Duct Insulation throughout the renovation areas were evaluated to be intact.

Since this is a replacement project of AHU-5 it is understood that some of the duct work might need to be removed and replaced for the new unit to function properly. All Category II ACM White/Tan Adhesive on Duct Insulation anticipated to be removed for this renovation project must be removed and disposed of by an Ohio Licensed Asbestos Abatement Contractor prior to any impact or disturbance via demolition work practices. It is anticipated that the abatement contractor will remove the ACM White/Tan Adhesive on Duct Insulation in conjunction with all the fiberglass duct insulation since it does not seem reasonably feasible to have the abatement contractor separate the ACM from the fiberglass duct insulation during conventional abatement work practices. With the addition of the fiberglass insulation approximately 5,343 square feet of material will need to be remediation as part of this project if all the duct work is to be removed. In locations where construction boundaries are erected segregating work areas from non-work areas, the abatement contractor will be required to conduct partial removal of this ACM to the extent of the limits of construction and then seal and encapsulate any exposed portions of remaining ACM insulation to an intact condition.



KEY PLAN

REV.	DATE	DESCRIPTION	AGENCY	BY
	OCT 77	AS CONSTRUCTED		EGH
1	9-18-74	EXTEND HVAC TO NEW CORRIDOR & REVISED 829 SYSTEM	AMK	WTF

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI DENVER NEW YORK

DEPARTMENT OF THE AIR FORCE
AERONAUTICAL SYSTEMS DIVISION
WRIGHT-PATTERSON A.F.B. OHIO

DESIGNED BY: MAS
DRAWN BY: TS
CHECKED BY: W.T.F.
A.E. JOB NO. 2155

ADDITION TO
TECHNICAL INTELLIGENCE OPERATIONS FACILITY
BUILDING 856 AREA A

SUBMITTED BY: DATE: FEB. 27, 1974
APPROVAL RECOMMENDED BY: CHIEF DESIGN
APPROVED BY: CIVIL ENGINEER

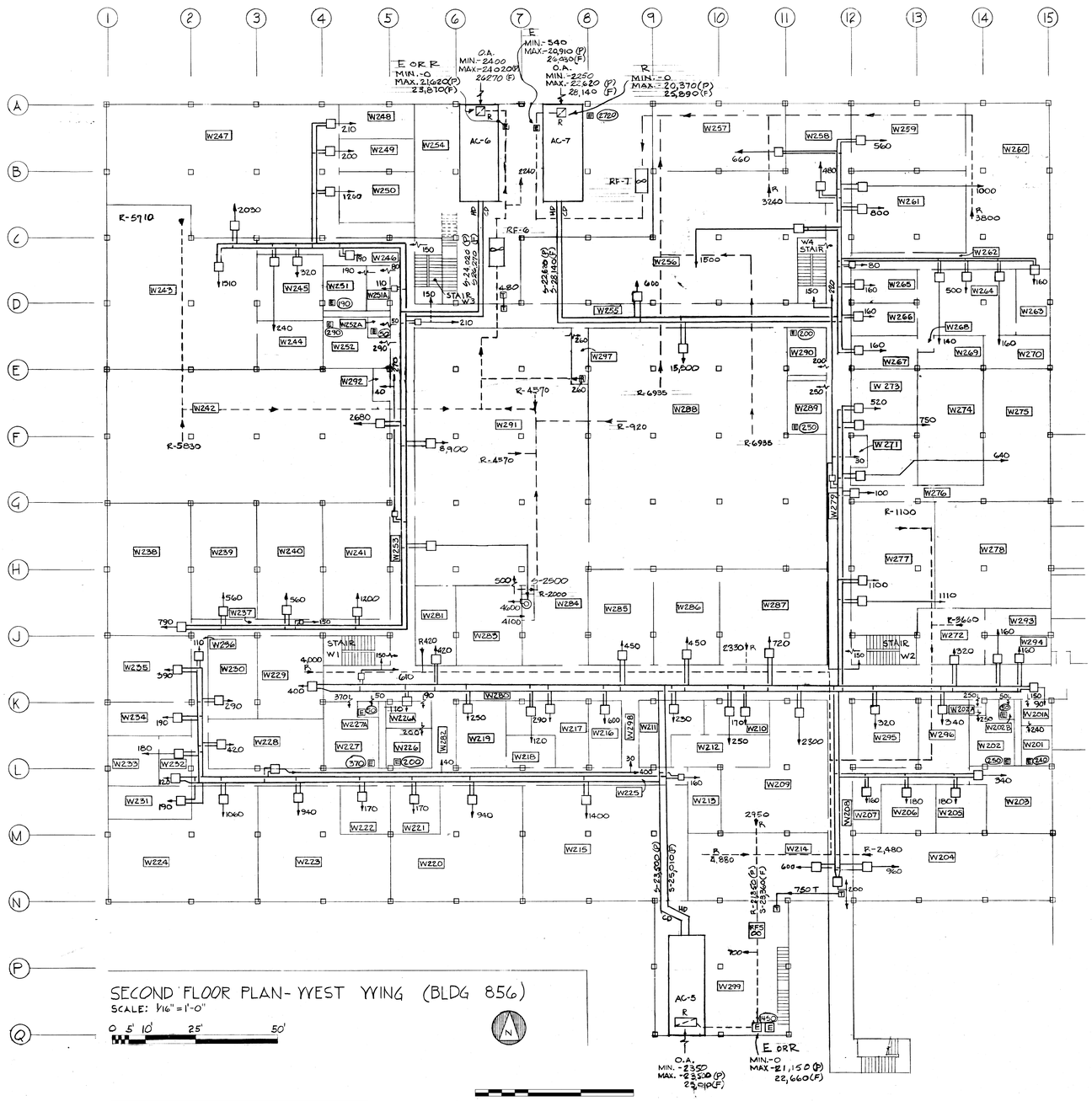
STATE OF OHIO R. C. WIER 24646 REGISTERED PROFESSIONAL ENGINEER

H.V.A.C.
SECOND FLOOR PLAN
WEST WING - SECTION 3

SCALE: 1/8" = 1'-0"
PROJECT NO.: AS-BLT.
DWG. NO. 74 WA 1863
SIZE: F
SHEET NO. M-14 OF

SEQUENCE NO. 172 OF 206

102172



SECOND FLOOR PLAN- WEST WING (BLDG 856)

SCALE: 1/16" = 1'-0"

0 5' 10' 25' 50'

GENERAL SHEET NOTES

APPROXIMATLY 1,300 SQUARE FEET OF CATEGORY II ACM DUCT INSULATION WRAP AND ADHESIVE ASSOICATED WITH AHU #5 IS ANTICIPATED TO BE REMOVED AS PART OF THIS PROJECT.

DAMAGE PIPE JOINTS AND INSULATION AROUND THE PIPES WERE OBSERVED IN MECHANICAL ROOM W299 (PIPING ASSOCIATED WITH AHU#5). 5 PIPE JOINTS/FITTINGS AND 36 LINEAR FEET OF CATEGORY II ACM PIPING WERE NOTED IN THIS LOCATION AND WILL BE REMOVED AS PART OF THIS INVESTIGATION.

THERE IS 10 SQUARE FEET OF ASSUMED ACM VIBRATION CLOTH ASSOCIATED WITH THE REMOVAL OF AHU-5.

THERE IS ONE ELECTRICAL BOX ASSOCIATED WITH AHU-5 WHICH CONTAINS ~100 SQUARE FEET OF TRANSITE PANEL THAT WILL BE REMOVED AS PART OF THIS PROJECT.

CATEGORY II ACM MASTIC ASSOCIATED WITH AHU #5 WAS DETERMINED TO BE PRESENT WITHIN/ON THE UNIT. THE FOLLOWING WERE TYPES OF MASTIC IDENTIFED:

- YELLOW DUCT MASTIC – ~15 SQUARE FEET APPLIED ON AHU #5 DUCT TRANSITION SEAM
- GRAY DUCT MASTIC – ~25 SQUARE FEET APPLIED ON AHU #5 SEAMS OF THE ENTIRE UNIT

THESE MATERILAS WILL NEED TO BE REMOVED AS PART OF THIS RENOVATION PROJECT.

CATEGORY II ACM WHITE ADHESIVE (~71 SQUARE FEET) AND GRAY CAULK (~10.25 SQUARE FEET) WERE DETERMINED TO BE PRESENT ON THE VAV BOXES THROUGHOUT THE RENOVATION AREAS AND WILL NEED TO BE REMOVED AS PART OF THIS RENOVATION PROJECT.

AC-6

ROOM NO.	SUPPLY AIR DEVICES QUAN	TYPE	CFM EACH DESIGN	ACTUAL	RETURN AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL	EXHAUST AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL
W237	3	A	50		—	—	—		—	—	—	
W238	11	A	72		20	C	39		—	—	—	
W239	7	A	80		14	C	40		—	—	—	
W240	7	A	80		14	C	40		—	—	—	
W241	14	A	86		14	C	40		—	—	—	
					1	F	640		—	—	—	
W242	35	A	77		67	C	40		—	—	—	
W243	22	A	69		41	C	37		—	—	—	
W244	4	A	60		6	C	40		—	—	—	
W245	4	A	80		8	C	40		—	—	—	
W246	3	A	63		—	—	—		—	—	—	
W247	29	A	70		51	C	40		—	—	—	
W248	3	A	70		4	C	53		—	—	—	
W249	3	A	67		4	C	50		—	—	—	
W250	8	B	150		8	C	50		—	—	—	
					1	F	800		—	—	—	
W251	—	—	—		—	—	—		1	G	190	
W251A	1	E	110		—	—	—		—	—	—	
W252	—	—	—		—	—	—		1	G	290	
W252A	—	—	—		—	—	—		1	G	50	
W253	5	A	54		—	—	—		—	—	—	
W254	1	K	2240		—	—	—		1	G	2720	
					—	—	—		1	H	480	
W255	4	A	53		—	—	—		1	H	480	
W283	14	D	328		20	N	205		—	—	—	
W291	46	M	194		81	C	50		—	—	—	
	—	—	—		4	F	1270		—	—	—	
W292	1	K	40		—	—	—		—	—	—	
W297	—	—	—		—	—	—		1	F	260	
STAIR W-3	1	K	15		—	—	—		—	—	—	

AC-7

ROOM NO.	SUPPLY AIR DEVICES QUAN	TYPE	CFM EACH DESIGN	ACTUAL	RETURN AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL	EXHAUST AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL
W256	8	A	75		52	C	40		—	—	—	
	19	A	79						—	—	—	
W257	8	A	83		16	C	41		—	—	—	
W258	6	A	80		12	C	40		—	—	—	
W259	9	A	92		14	C	33		—	—	—	
					1	F	100					
W260	13	A	77		25	C	36		—	—	—	
					1	F	100					
W261	10	A	80		15	C	33		—	—	—	
					2	F	100					
W262	1	A	80		—	—	—		—	—	—	
W263	3	A	53		4	C	40		—	—	—	
W264	8	A	63		13	C	38		—	—	—	
W265	3	A	53		4	C	40		—	—	—	
W266	3	A	53		4	C	40		—	—	—	
W267	3	A	53		4	C	40		—	—	—	
W269	3	A	46		3	C	46		—	—	—	
W270	3	A	53		4	C	40		—	—	—	
W288	100	M	155		92	C	40		—	—	—	
	—	—	—		8	F	400		—	—	—	
	—	—	—		9	F	958		—	—	—	

* INCLUDES W284
** INCLUDES W268

AC-5

ROOM NO.	SUPPLY AIR DEVICES QUAN	TYPE	CFM EACH DESIGN	ACTUAL	RETURN AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL	EXHAUST AIR DEVICES NO.	TYPE	CFM EACH DESIGN	ACTUAL
W201	—	—	—		—	—	—		1	G	240	
W201A	1	E	90		—	—	—					
W202	—	—	—		—	—	—		1	G	250	
W202A	—	—	—		—	—	—					
W202B	—	—	—		—	—	—		1	G	50	
W203	4	A	85		8	C	43		—	—	—	
W204	12	A	80		24	C	40		—	—	—	
W205	4	A	45		5	C	36		—	—	—	
W206	4	A	45		4	C	45		—	—	—	
W207	2	A	80		4	C	40		—	—	—	
W208	5	A	40		—	—	—		1	H	750	
W209	15	M	153		18	C	40		—	—	—	
	—	—	—		4	F	395		—	—	—	
W210	2	A	85		4	C	43		—	—	—	
W211	4	A	58		6	C	38		—	—	—	
W212	4	A	63		6	C	42		—	—	—	
W213	2	A	80		4	C	40		—	—	—	
W214	8	A	75		16	C	37		—	—	—	
W215	18	A	78		35	C	40		—	—	—	
W216	4	B	150		4	C	40		—	—	—	
					2	F	220		—	—	—	
W217	5	A	58		7	C	42		—	—	—	
W218	2	A	60		3	C	40		—	—	—	
W219	4	A	63		6	C	42		—	—	—	
W220	10	A	78		24	C	39		—	—	—	
	1	B	160						—	—	—	
W221	2	A	85		4	C	43		—	—	—	
W222	2	A	85		5	C	34		—	—	—	
W223	10	A	78		23	C	41		—	—	—	
	1	B	160						—	—	—	
W224	11	A	82		27	C	39		—	—	—	
	1	B	164						—	—	—	
W225	7	A	57		—	—	—		—	—	—	
W226	—	—	—		—	—	—		1	G	200	
W226A	1	E	110		—	—	—		—	—	—	
W227	—	—	—		—	—	—		1	G	370	
W227A	—	—	—		—	—	—		1	G	50	
W228	6	A	70		11	C	38		—	—	—	
W229	5	A	80		10	C	40		—	—	—	
W230	5	A	58		7	C	41		—	—	—	
W231	3	A	63		5	C	38		—	—	—	
W232	2	A	60		3	C	40		—	—	—	
W233	3	A	60		4	C	45		—	—	—	
W234	3	A	63		5	C	38		—	—	—	
W235	1	A	78		10	C	39		—	—	—	
	2	B	156						—	—	—	
W236	2	A	55		—	—	—		—	—	—	
W271	1	K	30		—	—	—		—	—	—	
W272	4	A	80		6	C	53		—	—	—	
W273	7	A	74		13	C	32		—	—	—	
					1	F	100		—	—	—	
W274	10	A	75		18	C	33		—	—	—	
					2	F	100		—	—	—	
W275	8	A	80		16	C	40		—	—	—	
W276	2	A	50		—	—	—		—	—	—	
W277	8	B	137		19	C	40		—	—	—	
					2	F	170		—	—	—	
W278	14	A	79		21	C	40		—	—	—	
					2	F	135		—	—	—	
W279	4	A	55		—	—	—		—	—	—	
W280	10	A	61		—	—	—		—	—	—	
W281	2	A	70		4	C	40		—	—	—	
	2	B	140		1	F	260		—	—	—	
W282	1	A	40		—	—	—		—	—	—	
W285	4	A	75		10	C	45		—	—	—	
	1	B	150						—	—	—	
W286	4	A	75		10	C	45		—	—	—	
	1	B	150						—	—	—	
W287	10	A	72		15	C	48		—	—	—	
W289	—	—	—		—	—	—		1	G	250	
W290	—	—	—		—	—	—		1	G	200	
W293	2	A	80		4	C	40		—	—	—	
W294	2	A	80		2	C	40		—	—	—	
					1	E	80		—	—	—	
W295	4	A	80		8	C	40		—	—	—	
W296	3	B	113		9	C	38		—	—	—	
W298	1	A	30		—	—	—		—	—	—	
W299	1	K	700		—	—	—		1	G	1450	
	—	—	—		—	—	—		1	H	750	
STAIR W4	1	B	150		—	—	—		—	—	—	
STAIR W-2	1	B	150		—	—	—		—	—	—	
STAIR W-4	1	B	150		—	—	—		—	—	—	

LEGEND
(AIR FLOW DIAGRAMS ONLY)

- S SUPPLY AIR ————
- T TRANSFER AIR
- HD HOT DECK SUPPLY AIR
- CD COLD DECK SUPPLY AIR
- E EXHAUST (300)
- R RETURN -(RETURN THRU EACH LIGHTING TROFFER UNLESS OTHERWISE INDICATED) - - - - - -
- INDICATES MIXING BOXES FOR AREAS SHOWN (NOT NECESSARILY THE NUMBER OF BOXES)
- O.A. OUTSIDE AIR
- RF RETURN FAN
- AC AIR CONDITIONING UNIT
- W220 ROOM NUMBER
- 1400 NUMBERS SHOWN ARE CFM (CUBIC FEET PER MINUTE OF AIR)
- P PRESENT DESIGN
- F FUTURE DESIGN (EQUIPMENT AND MAIN DUCTS SIZED FOR 25% FUTURE INCREASE OF INTERNAL EQUIPMENT. HEAT LOADS ONLY BRANCH DUCT SYSTEMS SIZED FOR PRESENT.)

STATE OF OHIO
R. C. WIER
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REGISTERED PROFESSIONAL ENGINEER

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DEPARTMENT OF THE AIR FORCE
AERONAUTICAL SYSTEMS DIVISION
WRIGHT-PATTERSON A.F.B. OHIO

ADDITION TO
TECHNICAL INTELLIGENCE OPERATIONS FACILITY
BUILDING 856 AREA A

DESIGNED BY: LAB
DRAWN BY: RE
CHECKED BY: W.A.H.
A.E. JOB NO. 2155
SUBMITTED BY: DATE: FEB 27, 1974
APPROVAL RECOMMENDED BY: CHIEF DESIGN
APPROVED BY: CIVIL ENGINEER

SCALE: NONE
H.V.A.C.
AIR FLOW DIAGRAM
SECOND FLOOR-WEST WING

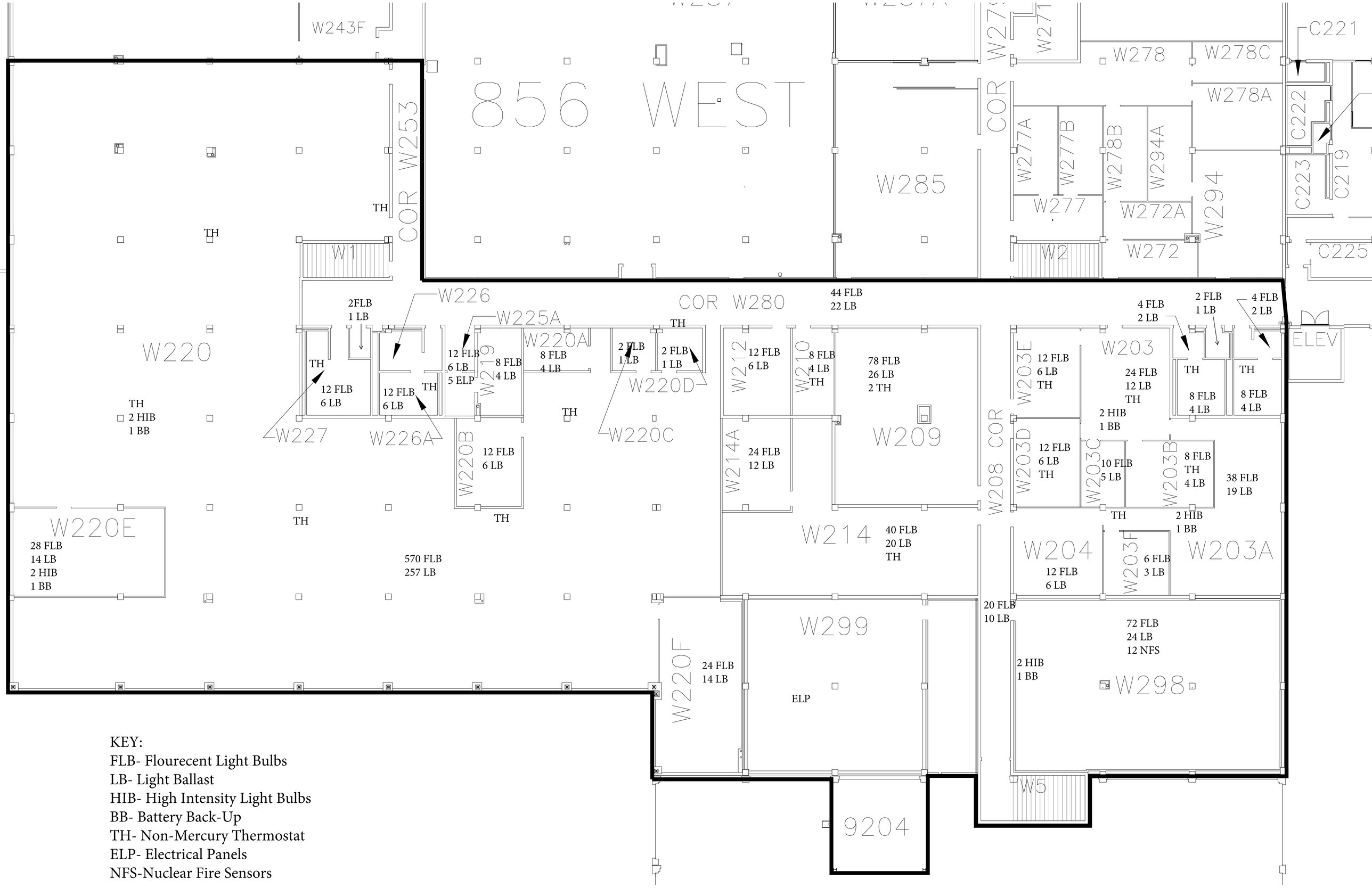
PROJECT NO.: AS-BLT.
DWG. NO. 74 WA 1863
SIZE F
SHEET NO. M-5 OF

SEQUENCE NO. 163 OF 206

102163

APPENDIX H-8

HAZARDOUS MATERIALS LOCATION



KEY:
FLB- Flourecent Light Bulbs
LB- Light Ballast
HIB- High Intensity Light Bulbs
BB- Battery Back-Up
TH- Non-Mercury Thermostat
ELP- Electrical Panels
NFS-Nuclear Fire Sensors

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SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
02/19

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

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Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: https://assist.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, DC 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet:
https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc

U.S. DEPARTMENT OF ENERGY (DOE)
1000 Independence Avenue Southwest
Washington, D.C. 20585
Ph: 202-586-5000
Fax: 202-586-4403
E-mail: The.Secretary@hq.doe.gov
Internet: https://www.energy.gov/

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-564-4700
Internet: https://www.epa.gov

--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6060 or 1-800-363-2068
Fax: 703-605-6880
TDD: 703-487-4639
E-mail: info@ntis.gov
Internet: https://www.ntis.gov/

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
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U.S. Government Publishing Office (GPO)
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Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/
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U.S. Department of Transportation
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591
Ph: 866-835-5322
Internet: https://www.faa.gov/

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)
445 12th Street SW
Washington, DC 20554
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TTY: 888-835-5322
Fax: 866-418-0232
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U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)
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Washington, DC 20590
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
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Acquisition Streamlining and Standardization Information System (ASSIST)
Internet: https://assist.dla.mil/online/start/; account registration required

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
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U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577 or 360-817-5500
E-mail: CustomerExperienceCenter@ul.com
Internet: https://www.ul.com/
UL Directories available through IHS at https://ihsmarkit.com/

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00.15 10

RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)
11/16, CHG 2: 08/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Closeout
Import/Export of Data

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some correspondence, including pay requests and payrolls, are also to be provided in paper format with original signatures. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the reporting accomplished through RMS. Particular attention is directed to

FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; Section 01 32 01.00 10 PROJECT SCHEDULE; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26.00 06 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 04.10 06 CONTRACTOR QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a web based application. Download, install and be able to utilize the latest version of RMS within 7 calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (https://rms.usace.army.mil). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

1.5 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance(QA)comments, as well as other miscellaneous administrative information.

1.6 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 calendar days of receiving access to the contract in RMS. This includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

1.6.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within 7 calendar days of receiving access to the contract in RMS or within 7 calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

1.6.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office

with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters are numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C" or "RFP".

1.6.1.4 Equipment

Enter and maintain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Reports

Track the status of the project utilizing the reports available in RMS. The value of these reports is reflective of the quality of the data input. These reports include the Progress Payment Request worksheet, Quality Control (QC) comments, Submittal Register Status, and Three-Phase Control worksheets.

1.6.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

1.6.2 Finances

1.6.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project schedule. The sum of pay activities equals the total contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities assigned to a CLIN equals the amount of each CLIN.

1.6.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work completed under the contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data either electronically or by hard copy. Unless waived by the Contracting Officer, a signed paper copy of the approved payment certification and request is also required and will govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC Control System, QC testing, transferred and installed property and warranties in RMS. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Insure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments of same within 7 calendar days of Government acceptance of the CQC Plan.

1.6.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (QC) Daily Report in RMS is the official report. The Contractor can use other supplemental formats to record QC data, but information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

1.6.3.2 Deficiency Tracking.

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

1.6.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS. Worksheets for the three-phase control meetings are generated within RMS.

1.6.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

1.6.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26.00 06 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

1.6.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

1.6.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

1.6.4 Submittal Management

Enter all current submittal register data and information into RMS within 7 calendar days of receiving access to the contract in RMS. The information shown on the submittal register following the specification

Section 01 33 00 SUBMITTAL PROCEDURES will already be entered into the RMS database when access is granted. Group electronic submittal documents into transmittal packages to send to the Government, except very large electronic files, samples, spare parts, mock ups, color boards, or where hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

1.6.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in Section 01 32 01.00 13 PROJECT SCHEDULE.

1.6.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

1.7 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

1.8 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within 7 calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 45 04.10 06

CONTRACTOR QUALITY CONTROL
04/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

1.3 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval, or for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Quality Control Plan; G, RO

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with FAR 52.246-12 - Inspection of Construction. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project

superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2 NOT USED

3.3 CONSTRUCTION QUALITY CONTROL PLAN (CQCP)

The Contractor shall furnish for review by the Government, not later than thirty (30) days after receipt of notice to proceed, the Contractor Construction Quality Control (CQC) Plan proposed to implement the requirements of FAR 52.246-12 - Inspection of Construction. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first thirty (30) days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.3.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to someone higher in the Contractor's organization than the project superintendent, shall not be the superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.3.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.3.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.4 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of thirty (30) calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual

understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the jobsite, the CQC System Manager will train the Subcontractor and answer any questions pertaining to quality control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A record of the orientation shall be documented in the QC Report.

3.5 CONSTRUCTION QUALITY CONTROL ORGANIZATION

3.5.1 Personnel Requirements

a. The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. A Site Safety Health Officer (SSHO) will be required for this contract. See LRL Section 01 35 26.00 06 GOVERNMENT SAFETY REQUIREMENTS for the SSHO qualifications and duties.

b. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC, and safety/health organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times and made available to the SSHO, except as otherwise acceptable to the Contracting Officer.

3.5.2 CQC System Manager Qualifications and Duties

a. The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 10 years construction experience on construction similar to this contract, or a construction person with a minimum of 15 years in related quality management work.

b. This CQC System Manager shall be employed by the Prime Contractor and be on the site at all times during construction. Alternate(s) for the CQC System Manager shall be identified in the CQC Plan to serve in the event of the CQC System Manager's absence. The requirements for the alternates shall be the same as for the designated CQC System Manager.

c. The CQC System Manager shall be:

Assigned as the CQC System Manager, and shall not be the SSHO or Superintendent.

3.5.3 CQC Personnel

a. In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas identified per Experience Matrix Table. These individuals may be employees of the prime or subcontractor. These individuals identified per the Experience Matrix Table, shall be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals in the Experience Matrix Table may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.

b. The word "graduate" below indicates an individual possessing a four-year college degree accredited in the respective field listed-with experience obtained following graduation in the type of work being performed on the project.

Experience Matrix Table

AREA	QUALIFICATIONS
Mechanical	Individual can be a subcontractor, but must be on site when work is occurring. Individual reports to the QCM.

3.5.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager and Alternate(s) shall have completed and passed the course entitled "Construction Quality Management For Contractors" within the last 5 years. A copy of the certification shall be provided with the CQCP. This course is periodically offered by the Associated Builders and Constructors, Inc., or Associated General Contractor, Inc., and the U.S. Army Corps of Engineers.

3.5.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.6 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.7 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.7.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

e. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

f. A review of the appropriate activity hazard analysis to assure safety requirements are met.

g. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

h. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

i. Resolve all differences.

j. Discussion of the initial control phase.

k. Review of provisions that have been made to provide required control inspection and testing.

l. Review of the CQC plan, specifically its organization chart and delegation letters. Insure all required members of the CQC organization for this feature of work are qualified, have been appointed, accepted and have requisite authority delegated.

m. The Government shall be notified at least 24 hours in advance of

beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.7.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 72 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.7.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.7.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems

develop.

3.8 TESTS

3.8.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. For QC testing of construction materials including soil, rock, aggregate, asphalt, concrete, and steel, the Contractor shall procure the services of a Corps of Engineers (COE) validated testing laboratory or establish a COE validated testing laboratory at the project site. Technical specifications included in the contract that require materials testing by an approved commercial testing laboratory shall be intended to mean by a COE validated laboratory. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.8.2 Testing Laboratories

3.8.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D3740 and ASTM E329.

3.8.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $1,375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently

selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.8.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail:

Geotechnical & Structures Laboratory
Material Testing Center (GS-E)
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.9 COMPLETION INSPECTION

3.9.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the FAR 52.211-10 - Commencement, Prosecution, and Completion of Work, or by the specifications, the CQC System Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.9.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.9.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least fourteen (14) days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR 52.246-12 - Inspection of Construction.

3.10 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report. All calendar days shall be accounted for throughout the life of the contract. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

l. Deficiency Tracking System. The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those failures, Government oral observations and Notifications of Noncompliance. The list shall be maintained at the project site. Copies of updated listings shall be submitted to the Government at least every thirty (30) days.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

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SECTION 01 46 00.00 06

TOTAL BUILDING COMMISSIONING
04/20

PART 1 GENERAL

Commission the building systems listed herein. Employ the services of independent Commissioning Specialists. The Commissioning Specialists must be 1st tier subcontractors of the General or Prime Contractor and must be financially and corporately independent of all other subcontractors. The Commissioning Specialists must coordinate all aspects of the commissioning process. Conform to the commissioning procedures outlined in this specification.

1.1 SYSTEMS TO BE COMMISSIONED

Commission the following systems:

Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC)

Building Automation System

Utility Monitoring and Control System

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 180	(2018) Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
ASHRAE 202	(2018) Commissioning Process for Buildings and Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline	(2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard	(2018) Whole Building Technical Commissioning of New Construction

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 014-2013	(2013) HVAC Systems Commissioning Manual, 2nd Edition

US Army Corps of Engineers (USACE)

ER 25-345-1 Regulation No. 25-345-1Military Publications SYSTEMS MANUAL

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Commissioning Specialists G, DO

Submit the Commissioning Specialists' certification of qualifications no later than 30 calendar days after Notice to Proceed. Submit one electronic copy.

Project Schedule; G, DO

Project construction schedule which includes commissioning milestone activities. Submit within 14 calendar days following the Construction Commissioning Coordination Meeting. Submit one hard copy and an electronic copy.

SD-06 Test Reports

Construction Phase Commissioning Plan; G, DO

Submit no later than 30 calendar days after the Construction Commissioning Coordination Meeting. Submit one hard copy and an electronic copy.

PVT Procedures; G, DO

Submit no later than 14 calendar days prior to Performance Verification Tests. Submit one hard copy and an electronic copy.

PVT Report; G, DO

Submit no later than 30 calendar days prior to Functional Performance Tests. Submit one hard copy and an electronic copy.

Issues Log

Submit one hard copy and an electronic copy on the same day each month.

Trend Log Report

Submit one electronic copy no later than 14 calendar days prior to Functional Performance Tests.

Commissioning Report; G, DO

Submit no later than 14 calendar days following commissioning team

acceptance of all Performance Tests. Submit one hard copy and an electronic copy.

SD-07 Certificates

Certificate of Readiness; G, DO

Submit no later than 14 calendar days prior to Functional Performance Tests. Submit one electronic copy.

SD-10 Operation and Maintenance Data

Systems Training; G, DO

Submit one copy of the Systems Training recording no later than 14 calendar days following completing of the Systems Training.

Training Plan; G, RO

Submit one hard copy and an electronic copy no later than 30 calendar days prior to the associated training.

Training Attendance Rosters; G, RO

Submit one hard copy and an electronic copy no later than 7 calendar days following the completion of the training for each system to be commissioned.

Systems Manual; G, DO

Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests. Submit one hard copy and an electronic copy.

Maintenance and Service Life Plans; G, DO

Submit the Maintenance Plan and Service Life Plan no later than 30 calendar days following the completion of Functional Performance tests. Submit one hard copy and an electronic copy.

1.4 COMMISSIONING SPECIALISTS

1.4.1 Lead Commissioning Specialist (CxC/CxS)

The Lead Commissioning Specialist must lead and oversee all commissioning work specified herein and be the primary point of contact for the Government regarding commissioning work. The Lead Commissioning Specialist (CxC/CxS) must have a minimum of five years of commissioning experience, including two projects of similar size and complexity. The Lead Commissioning Specialist must also be one of the following:

a. AABC Commissioning Group (ACG) Certified Commissioning Authority

b. Building Commissioning Association (BCA) Certified Commissioning Professional

c. International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB) Certified Commissioning Supervisor

d. National Environmental Balancing Bureau (NEBB) Qualified Systems Commissioning Administrator

e. University of Wisconsin-Madison Qualified Commissioning Provider

1.4.2 Commissioning Specialists Certification

The Commissioning Specialists' qualifications must include the names of the specialists and firms; certifications, licenses, or registrations; years of experience and a listing of representative projects of similar size and complexity. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed specialists or firms in detail. Any specialist/technician or firm that has been the subject of disciplinary action by the certifying body within the five years preceding the contract award is not eligible to perform any duties related to commissioning.

The Commissioning Specialists' certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, a Commissioning Specialist loses a certification during this period, immediately notify the Contracting Officer's Representative and submit another Commissioning Specialist. All work specified in this specification section to be performed by the Commissioning Specialist is invalid if the Commissioning Specialist loses their certification prior to contract completion and must be performed by an approved successor.

1.4.3 Communication With The Government

The Lead Commissioning Specialist must submit all plans, schedules, reports, and documentation directly to the Contracting Officer's Representative concurrent with submission to the CQC System Manager. The Commissioning Specialists and Contracting Officer's Representative must have direct communication with each other regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Commissioning Specialists.

1.5 COMMISSIONING STANDARD

Comply with the requirements of the commissioning standard under which the Commissioning Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, or the University of Wisconsin-Madison, comply with the requirements of one of the acceptable standards unless otherwise stated herein. The acceptable standards are ACG Commissioning Guideline, NEBB Commissioning Standard, ANSI/SMACNA 014-2013, or ASHRAE 202.

a. Implement all recommendations and suggested practices contained in the Commissioning Standard and electrical test standards.

b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.

c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.

d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.

e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.

f. Use any new requirements, recommendations, and procedures published or adopted prior to contract solicitation by the body responsible for the Commissioning Standard.

1.6 ISSUES LOG

The Lead Commissioning Specialist must develop and maintain an Issues Log for tracking and resolution of all deficiencies discovered through submittal review, inspection, and testing. Include the date of final resolution of issues as confirmed by the Commissioning Specialists. Submit the Issues Log on a monthly basis at a minimum. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the Lead Commissioning Specialist for including into the Issues Log.

Track construction deficiencies identified in the Issues Log using RMS as specified in Specification Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

1.7 CERTIFICATE OF READINESS

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness certifying that the building system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; Completed Performance Verification Test Reports; completed Building Envelope Inspection Checklists; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; Trend Log Review Report. The Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; and the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness. Do not schedule and perform Functional Performance Tests prior to Government approval of the Certificate of Readiness.

1.8 PROJECT SCHEDULE

Include the following tasks in the Project Schedule provided in accordance with section 01 32 01.00 06 PROJECT SCHEDULE. Ensure sufficient time is scheduled to accommodate the requirements of this specification section. The order of items listed are not intended to imply a specified sequence:

a. Pre-Construction Conference

b. Electrical system energization.

c. Electrical system acceptance tests and inspections

d. Duct Air Leakage Tests

e. Manufacturer Equipment Start-Up for each system to be commissioned.

f. Testing, Adjusting, and Balancing (TAB)

g. TAB Verification

h. Performance Verification Tests

i. HVAC Trend Log Report

j. Pre-Functional Checklist Submittal

k. Functional Performance Testing

l. Demand Response Tests

m. Post-Test Deficiency Correction

n. Re-Testing

o. Training for each system to be commissioned

p. Systems Manual, Maintenance Plan, and Service Life Plan Submission

q. Submission and approval of the Commissioning Report

r. Seasonal Tests

aa. Monitoring Based Commissioning

bb. Monitoring Based Commissioning Report Submission

cc. Post-Construction Trend Log Reports

dd. Post-Construction Building Site Visit

1.9 FUNCTIONAL PERFORMANCE TEST PREREQUISITES

Complete the following prior to starting Functional Performance Tests of the mechanical systems:

a. All equipment and systems have been completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with the contract documents and construction plans and specifications.

b. Testing, Adjusting, and Balancing has been completed and the Testing, Adjusting, and Balancing Report has been submitted and approved in accordance with Section 23 05 93.00 06 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

c. Performance Verification Tests of the controls systems have been completed and the Performance Verification Tests Report has been submitted and approved in accordance with Specification Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

d. The Pre-Functional Checklists have been submitted and approved.

e. The Certificate of Readiness for the mechanical systems has been submitted and approved.

f. Submit test procedures at least 28 days prior to the start of Functional Performance Tests. Submit the schedule for the tests at least 14 days prior to the start of Functional Performance Tests.

PART 2 PRODUCTS(NOT APPLICABLE)

PART 3 EXECUTION

3.1 CONSTRUCTION PHASE

3.1.1 Construction Commissioning Coordination Meeting

The Lead Commissioning Specialist must lead a Construction Commissioning Coordination Meeting no later than 14 calendar days after approval of the Commissioning Specialists but no later than 60 calendar days after notice to proceed to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this specification section. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, the commissioning team (as described in 3.2.6.1) and the Government must attend this meeting. Invite the User and Base Civil Engineer Representative to attend this meeting.

3.1.2 Commissioning Progress Meetings

The Lead Commissioning Specialist must lead Commissioning Progress Meetings to discuss the progress of commissioning process activities, upcoming commissioning activities, and any issues and deficiencies. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, and the Government must attend this meeting. A representative from each of the sub-contractors involved in the systems to be commissioned must attend this meeting. Invite the User and Base Civil Engineer Representative to attend these meetings.

At the request of the Lead Commissioning Specialist, the Mechanical, Electrical, and Architectural designers of record must participate in the Commissioning Progress Meetings, to address any design issues or issues regarding technical adequacy.

Commissioning Progress Meetings must occur monthly following the Construction Commissioning Coordination Meeting. When installation of interior mechanical or electrical systems begins, the Commissioning Progress Meetings must occur every 2 weeks.

3.1.3 Construction Phase Commissioning Plan

The Lead Commissioning Specialist must prepare the Construction Phase Commissioning Plan identifying the commissioning and testing standards to be used and outlining the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, and the documentation requirements for the construction phase of the project. Include the pre-functional checklists, and Functional Performance Test checklists. The checklists are required to have the same level of detail as the example checklists provided in the appendices, but are not required to match the format.

The construction phase commissioning plan must include the monitoring and control points, sample frequency, and duration of trends for the trend log reviews.

3.1.3.1 Pre-Functional Checklists

The Commissioning Specialists must develop the Pre-Functional Checklists. Pre-Functional Checklists include items for physical inspection or testing that demonstrate that installation and start-up of all equipment and systems is complete. Refer to paragraph "Pre-Functional Checks" for more information. Appendix D provides examples of the minimum detail required for Pre-Functional Checklists.

3.1.3.2 Functional Performance Test Checklists

The Commissioning Specialists must develop the Functional Performance Test Checklists including procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. Refer to paragraph "Functional Performance Tests" for more information. Appendix E provides examples of the minimum detail required for Functional Performance Test Checklists.

Include the following sections and details appropriate to the systems being tested:

a. Notable system features including information about controls to facilitate understanding of system operation.

b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be accepted by the Government.

c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions.

d. Attendees.

e. Identification of the equipment involved in the test.

f. Control system feature identification.

g. Point-to-point observations including demonstrating system sensors and flow meters have been calibrated and are correctly displayed on the Operator work station. Actuator operation observations demonstrating actuator responses to commands from the control system.

h. As-found condition of the system operation.

j. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.

k. Space for comments for each test item.

3.1.4 Construction Submittals

Provide all submittals associated with the systems to be commissioned, including shop drawings; equipment submittals; test plans, procedures, and reports; and resubmittals to the Commissioning Specialists. The Commissioning Specialists must review the submittals to the extent necessary verify that the equipment and system installation will comply with the contract requirements and the requirements of the Basis of Design

and the Owner's Project Requirements Document.

3.1.5 Inspection and Testing

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform in accordance with contract documents and the Owner's Project Requirements. Requirements in related Sections are independent from the requirements of this Section and do not satisfy any of the requirements specified in this specification section. Provide all materials, services, and labor required to perform and submit the Pre-Functional Checks HVAC system trend logs, and Functional Performance Tests.

3.1.5.1 Commissioning Team

Provide a commissioning representative for each sub-contractor associated with the systems to be commissioned. Each commissioning representative is responsible for coordination of their respective sub-contractor's execution of the commissioning activities and participation in the inspection and testing required by this specification section. The designers listed below must be the designer of record for the respective system. Substitutes must be approved by the Contracting Officer's Representative.

Designate team members to participate in the building envelope inspections, Pre-Functional checks, and the Functional Performance Testing specified herein.

3.1.5.1.1 Mechanical Systems Team

The following team members must participate in Pre-Functional Checks and Functional Performance Testing of mechanical systems.

Designation	Function
CxC/CxS	Lead Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative (Functional Performance Tests Only)
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
MD	Mechanical Designer (Functional Performance Tests at CxC/CxS request)

3.1.5.1.2 Other Pre-Functional and Functional Performance Participants

The following may participate as team members during Pre-Functional Checks

and Functional Performance Testing:

Designation	Function
DPW	Directorate of Public Works Representative
BCE	Base Civil Engineer Office Representative
RD	Reserve Readiness Division Representative
PWD	Public Works Division Representative
User	Using Agent's Representative

3.1.5.2 Pre-Functional Checks

Pre-Functional Checklists from the approved Construction Phase Commissioning Plan must be completed by the commissioning team. Complete one Pre-Functional Checklist for each individual item of equipment or system for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting), panels, and controls. Indicate commissioning team member inspection and acceptance of each Pre-Functional Checklist item by initials. Acceptance of each Pre-Functional Checklist item by each team member indicates that item has been installed correctly and conforms to the construction contract and accepted design requirements in their area of responsibility. Commissioning Specialist acceptance of each Pre-Functional Checklist item indicates that each item has been installed correctly and in accordance with contract documents and the Owner's Project Requirements. Submit the completed and initialed Pre-Functional Checklists upon completion. Include manufacturer start-up checklists associated with the equipment with the submission of the Pre-Functional Checklists.

3.1.5.3 Testing, Adjusting, and Balancing (TAB) Verification

The Lead Commissioning Specialist must witness the TAB Verification performed in accordance with LRL section 23 05 93.00 06 TESTING, ADJUSTING, AND BALANCING OF HVAC. Identify any deficiencies in the Issues Log.

Following the testing, adjusting, and balancing of the systems and submission of a TAB Report and prior to scheduling Functional Performance Tests, perform a TAB verification with the Contracting Officer's Quality Assurance Representative present. The Lead Commissioning Specialist must witness the TAB verification.

Recheck a minimum of 10% of all readings listed in the TAB report during TAB verification. The Contracting Officer's Quality Assurance Representative will select the readings to be rechecked. If over 20% of the measurements rechecked fall outside of the specified tolerance from design requirements specified, recheck an additional 10% sample with selection of readings by the Contracting Officer's Quality Assurance Representative. If over 20% of the total rechecked readings fall outside of the required tolerance, the TAB Report will be considered invalid and all contract required testing, adjusting, and balancing work must be repeated.

Repair all insulation following completion of TAB Verification.

3.1.5.4 Building Control System Performance Verification Tests

The controls contractor must perform a Performance Verification Test (PVT) of the building control systems demonstrating that the control systems are in compliance with the requirements of the construction contract and accepted design. Show, step-by-step, the actions and results demonstrating that the systems perform in accordance with the sequences of operation. A one-point accuracy check will be performed for each sensor.

Prepare and submit PVT Procedures that list the step-by-step procedures to be performed during the tests and the expected results from each step that demonstrate contract and accepted design compliance. Start the Performance Verification Tests only after approval of the PVT Procedures.

Provide a PVT Report documenting all tests performed during the PVT and the results. Document all failures and associated repairs in the PVT Report.

The Lead Commissioning Specialist must review the PVT Procedures or Test Plan and the PVT Report required by Specification Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC AND 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION. Include a certification by the Lead Commissioning Specialist with each of these submittals that the submittals do not indicate any deficiencies in the HVAC systems or HVAC control systems.

3.1.5.5 HVAC System Trend Logs

Following approval of the Performance Verification Test (PVT) Report and prior to Functional Performance Testing, the Lead Commissioning Specialist must review trend logs from the heating, ventilation, air-conditioning, and refrigeration control systems to ensure that the systems have stable operation and operate as required by construction contract, the accepted design, and the Owner's Project Requirements. Review trends for all items of equipment including sensor inputs; valve and damper positions (command or feedback); equipment status, modes, and commands; and variable frequency drive commands. Control and monitoring points, sample frequency, and duration of trends must be in accordance with the approved Construction Phase Commissioning Plan. Provide a Trend Log Report that identifies any deficiencies noted in operation and includes a graphical representation of the trends.

3.1.5.6 Tests

3.1.5.6.1 Functional Performance Tests

Schedule personnel to attend the Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system and all deficiencies identified through any prior review, inspection, or test activity have been corrected. Functional Performance Tests must be performed with the Contracting Officer's Quality Assurance Representative present. The Lead Commissioning Specialist must lead and document all Functional Performance Tests for the systems to be commissioned with the Contractor and appropriate sub-contractors performing the Functional Performance Tests. The representatives listed in the paragraph "Commissioning Team" must attend the Functional Performance Tests. Abort the Functional Performance

Tests when any required commissioning team member is not present for the test.

Abort Functional Performance Tests when any system deficiency prevents the successful completion of the test.

3.1.5.6.1.1 Checklists

Use the Functional Performance Test Checklists from the approved Construction Phase Commissioning Plan to guide the Functional Performance Tests. Functional Performance Tests must be performed for each item of equipment and each system required to be commissioned and verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other system performance requirements comply with the construction contract and accepted design requirements regardless of the specific items listed within the Functional Performance Test Checklists provided. Testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. The order of components and systems to be tested must be determined by the Lead Commissioning Specialist.

3.1.5.6.1.2 Acceptance

Indicate acceptance of each item of equipment and systems tested by signature of each commissioning team member for each Functional Performance Test. The Contractor's Quality Control Representative and the Lead Commissioning Specialist must indicate acceptance after the equipment and systems are free of deficiencies.

3.1.5.6.2 Sample Strategy

Perform Functional Performance Tests using the following sample strategy. Prepare and complete a Functional Performance Test Checklist for each item of equipment or system to be tested. For sample sizes less than 100 percent for all similar equipment, the Government will select the specific equipment or system to be tested during testing. Equipment Identifiers are as indicated on the design drawings:

Equipment Identifier	**Sample Size (Percent)**
AHU	100
VAV	10
Associated HW/CW down line devices	10

Perform Functional Performance Tests for all equipment and systems. Prepare and complete a Functional Performance Test Checklist for each item of equipment or system.

3.1.5.6.3 Seasonal Tests

Regardless of the season, perform initial Functional Performance Tests of equipment and systems at the time of system completion. Develop and implement means of artificial loading to demonstrate, to a reasonable level of confidence, the ability of the HVAC systems to handle peak seasonal loads.

In addition to the initial Functional Performance Tests, perform

Functional Performance Tests of the HVAC systems during peak heating and cooling seasons during outdoor air condition design extremes. Schedule the seasonal Functional Performance Tests in coordination with the Government.

Systems may be partially accepted by the Government prior to seasonal testing if they comply with all construction contract and accepted design requirements that can be tested during the initial Functional Performance Tests. All Functional Performance Test procedures must be completed prior to full systems acceptance.

3.1.5.6.4 Aborted Tests and Re-Testing

Abort Functional Performance Tests or Seasonal Tests if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Reimburse the Government for all costs associated with effort lost caused by re-testing due to test failures and aborted tests. These costs must include salary, travel costs, and per diem for Government commissioning team members. Re-test only after all deficiencies identified during the original tests have been corrected.

3.1.5.6.4.1 100% Sample

Systems or items of equipment for which 100% sample are tested fail if one or more of the test procedures results in a discovery of a deficiency and the deficiency can not be resolved within 5 minutes during the test. Upon test failure, abort the test of the system or item of equipment. Schedule a re-test, in coordination with the Government, only after all deficiencies for all failed equipment and systems have been corrected.

Re-test to the extent necessary to confirm that the deficiencies have been corrected. At the sole discretion of the Government, all test procedures for the failed item of equipment or system must be repeated to confirm that no deficiencies remain within that equipment or system.

3.1.5.6.4.2 Less than 100% Sample

For systems or equipment tests with a sample size less than 100 percent, if one or more of the test procedures for an item of equipment or system results in discovery of a deficiency, regardless of whether the deficiency is corrected during the sample tests, the item of equipment or system fails the test. Correction of the deficiencies during Functional Performance Testing may be performed only at the sole discretion of the Government.

If the system failure rate is 5 percent or less, meaning that 5 percent or less of the equipment or systems had at least one deficiency, re-test only the items which experienced the initial failures.

If the system failure rate is higher than 5 percent, meaning that more than 5 percent of the equipment or systems tested had at least one deficiency, re-test the items which experience the initial failures. In addition, test another sample of the same size as the initial sample for the first time. If the second sample set has any failures, re-test those failed items and all remaining equipment and systems to complete 100 percent testing of that system type.

3.2 SYSTEMS TRAINING

The training specified by the specification sections associated with commissioned systems must be provided by factory certified technicians or trainers. Include both demonstration of proper equipment and system operation both at the equipment and classroom training. For the classroom training, include proper operating and maintenance procedures, preventative maintenance requirements and procedures, trouble-shooting procedures, and calibration frequency and procedures. Include identification of the equipment and system warranties and procedures for correction under the warranties. Include a review of the draft systems manual, maintenance plan, and service life plans.

Visibly and audibly record the systems training. All instruction on the recording must be clear and intelligible.

3.3 TRAINING PLAN

Develop a training plan which identifies all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the trainer name, trainer contact information, and schedule and location of training.

Document training attendance using Training Attendance Rosters and provide completed attendance rosters to the Lead Commissioning Specialist and the Government.

3.4 SYSTEMS MANUAL

Prepare and submit a Systems Manual including a signed certification or letter from the Lead Commissioning Specialist and Electrical Commissioning Specialist stating that the Systems Manual is complete, clear, and accurate. The Systems Manual, for all commissioned systems, must conform to Appendix A SYSTEMS MANUAL ORGANIZATION AND CONTENT to ER 25-345-1, available at the USACE Publications website at the following location: https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations/ Update and resubmit the Systems Manual based on any corrective action taken during the warranty period.

3.5 MAINTENANCE AND SERVICE LIFE PLANS

Prepare and submit a Maintenance Plan for the project mechanical, electrical, plumbing, and fire protection systems. Prepare the Maintenance Plan in accordance with ASHRAE 180 for heating, ventilation, air conditioning, and refrigeration systems. Develop required inspection and maintenance tasks similar to Section 5 of ASHRAE 180 for the other commissioned systems and fire protection systems.

Prepare and submit a Service Life Plan for the building envelope, structural systems, and site hardscape that includes the following for each assembly or component:

a. A description of each including the materials or products.

b. The estimated service life, in years.

c. The estimated maintenance frequency and description of maintenance tasks.

d. The point of maintenance access for the components with estimated service life less than service life of the building.

3.6 COMMISSIONING REPORT

Following the completion of Functional Performance Tests, with the exception of Seasonal Tests, the Lead Commissioning Specialist must prepare a Commissioning Report including an executive summary describing the overall commissioning process, describing the results of the commissioning process, listing any outstanding deficiencies and recommended resolutions, and describing any seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the construction contract and accepted design and the Owner's Project Requirements.

Detail any deficiencies discovered during the commissioning process and the corrective actions taken. Include the completed Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists, Demand Response Test Checklists, the Construction Phase Commissioning Plan, the Issues Log, Performance Verification Test Reports, Trend Log Reports, Training Attendance Rosters, the Design Review Report, and the final TAB Report.

Following any Seasonal Tests or Post-Construction Activities, update the Commissioning Report to reflect any changes and resubmit.

3.7 POST-CONSTRUCTION SUPPORT

3.7.1 Post-Construction Site Visit

The Lead Commissioning Specialist must visit the building site concurrent with the 9 month warranty inspection to inspect building system equipment and review building operation with the building operating/maintenance staff. The Lead Commissioning Specialist must identify any deficiency of the building systems to operate in accordance with the contract and accepted design requirements and the Owner's Project Requirements. The Lead Commissioning Specialist must advise the Contracting Officer's Representative of any identified deficiencies and the proposed corrective action.

APPENDIX D

PRE-FUNCTIONAL CHECKLISTS

Pre-Functional checklist - Piping

For Hot Water Reheat Piping System _____

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. Piping complete.	___	___	___	___	___	___	___	___
b. As-built shop drawings submitted.	___	___	___	___	___	___	___	___
c. Piping flushed and cleaned.	___	___	___	___	___	___	___	___
d. Strainers cleaned.	___	___	___	___	___	___	___	___
e. Valves installed as required.	___	___	___	___	___	___	___	___
f. Piping insulated as required.	___	___	___	___	___	___	___	___
g. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___
h. Verify operation of valves.	___	___	___	___	___	___	___	___
i. Air vents installed as specified.	___	___	___	___	___	___	___	___
j. Flexible connectors installed as specified	___	___	___	___	___	___	___	___
k. Verify that piping has been labeled and valves identified as specified.	___	___	___	___	___	___	___	___

Pre-Functional Checklist - Ductwork

For Air Handler: ____

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. Ductwork complete.	___	___	___	___	___	___	___	___
b. As-built shop drawings submitted.	___	___	___	___	___	___	___	___
c. Ductwork leak test complete.	___	___	___	___	___	___	___	___
d. Access doors installed as required.	___	___	___	___	___	___	___	___
e. Ductwork insulated as required.	___	___	___	___	___	___	___	___
f. Thermometers and gauges installed as required.	___	___	___	___	___	___	___	___
g. Verify open/closed status of dampers.	___	___	___	___	___	___	___	___
h. Flexible connectors installed as specified	___	___	___	___	___	___	___	___

Pre-Functional Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: ____

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. Vibration isolation devices installed.	___	___	___	___	___	___	___	___
b. Inspection and access doors are operable and sealed.	___	___	___	___	___	___	___	___
c. Casing undamaged.	___	___	___	___	___	___	___	___
d. Insulation undamaged.	___	___	___	___	___	___	___	___
e. Condensate drainage is unobstructed. (Visually verify drainage by pouring A cup of water into drain pan.)	___	___	___	___	___	___	___	___
f. Fan belt adjusted.	___	___	___	___	___	___	___	___
g. Manufacturer's required maintenance clearance provided.	___	___	___	___	___	___	___	___
Electrical								
a. Power available to unit disconnect.	___	___	___	___	___	___	___	___
b. Power available to unit control panel.	___	___	___	___	___	___	___	___
c. Proper motor rotation verified.	___	___	___	___	___	___	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	___	___	___	___	___
Coils								
a. Chilled water piping properly connected.	___	___	___	___	___	___	___	___
b. Chilled water piping pressure tested.	___	___	___	___	___	___	___	___
c. Hot water piping properly connected.	___	___	___	___	___	___	___	___
d. Hot water piping pressure tested.	___	___	___	___	___	___	___	___

e. Air vents installed on water coils with shutoff valves as specified. ___ ___ ___ ___ ___ ___ ___ ___

f. Any damage to coil fins has been repaired. ___ ___ ___ ___ ___ ___ ___ ___

Controls

a. Control valves/actuators properly installed. ___ ___ ___ ___ ___ ___ ___ ___

b. Control valves/actuators operable. ___ ___ ___ ___ ___ ___ ___ ___

c. Dampers/actuators properly installed. ___ ___ ___ ___ ___ ___ ___ ___

d. Dampers/actuators operable. ___ ___ ___ ___ ___ ___ ___ ___

e. Verify proper location and installation of duct static pressure sensor. ___ ___ ___ ___ ___ ___ ___ ___

Pre-Functional Checklist - VAV Terminal

For VAV Terminal: _____

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. VAV terminal in place.	___	___	___	___	___	___	___	___
b. VAV terminal ducted.	___	___	___	___	___	___	___	___
c. VAV terminal connected to controls.	___	___	___	___	___	___	___	___
d. Reheat coil connected to hot water pipe.	___	___	___	___	___	___	___	___
e. Manufacturer's required maintenance clearance provided.	___	___	___	___	___	___	___	___
Controls								
a. VAV terminal controls set.	___	___	___	___	___	___	___	___

Pre-Functional Checklist - Return Fans

For Supply and Exhaust Fans: _____

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. Fan belt adjusted.	___	___	___	___	___	___	___	___
Electrical								
a. Power available to fan disconnect.	___	___	___	___	___	___	___	___
b. Proper motor rotation verified.	___	___	___	___	___	___	___	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	___	___	___	___	___
Controls								
a. Control interlocks properly installed.	___	___	___	___	___	___	___	___
b. Control interlocks operable.	___	___	___	___	___	___	___	___
c. Dampers/actuators properly installed.	___	___	___	___	___	___	___	___
d. Dampers/actuators operable.	___	___	___	___	___	___	___	___
e. Verify proper location and installation of thermostat.	___	___	___	___	___	___	___	___

Pre-Functional Checklist - HVAC System Controls

For HVAC System Controls

Checklist Item	QCR	CxA	MC	EC	CC	TABC	MD	ED
Installation								
a. As-built shop drawings submitted.	___	___	___	___	___	___	___	___
b. Layout of control panel matches drawings.	___	___	___	___	___	___	___	___
c. Framed instructions mounted in or near control panel.	___	___	___	___	___	___	___	___
d. Components properly labeled (on inside and outside of panel).	___	___	___	___	___	___	___	___
e. Control components piped and/or wired to each labeled terminal strip.	___	___	___	___	___	___	___	___
f. EMCS connection made to each labeled terminal strip as shown.	___	___	___	___	___	___	___	___
g. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	___	___	___	___	___	___
h. Shielded wiring used on electronic sensors.	___	___	___	___	___	___	___	___
Main Power and Control Air								
a. 110 volt AC power available to panel.	___	___	___	___	___	___	___	___

Pre-Functional Checklist - Lighting System (and Controls)
____ Entire Blg, ____ Floor #

Pre-Functional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report. Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others). Table will be completed for each room. EC/LC is installing contractor. QCR is contractor's quality control representative. CxA is commissioning authority/agent. Initial items when verified to be complete.

Check if Okay. Enter N/A if not applicable. Enter Note number if deficient (attach notes). Complete table for each room.

Check	Rooms				EC/LC	QCR	CxA
Lighting fixtures and switches are located per plans	___	___	___	___	___	___	___
Light switches are labeled with proper ID to match drawings or field changes	___	___	___	___	___	___	___
Light switch is controlling the fixtures in the area indicated on design drawings	___	___	___	___	___	___	___
Fixtures are properly supported for seismic zone	___	___	___	___	___	___	___
Verify proper fixture is installed to match fixture schedule and specifications	___	___	___	___	___	___	___
Lighting control is installed per manufacturer recommendations (attach recommendations to this checklist)	___	___	___	___	___	___	___
Lighting control is calibrated per manufacturer checklist	___	___	___	___	___	___	___

APPENDIX E

FUNCTIONAL PERFORMANCE TESTS CHECKLISTS

Functional Performance Test Checklist - VAV Terminals

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 percent.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes as per specifications including the following:

a. Cooling only VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 5 degrees F above ambient and measure maximum air flow. Turn thermostat to 5 degrees F below ambient and measure minimum air flow.

Maximum flow _____ cfm
Minimum flow _____ cfm

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ cfm
Minimum flow setting _____ cfm

b. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 5 degrees F above ambient measure maximum air flow. Turn thermostat to 5 degrees F below ambient and measure minimum air flow.

Maximum flow _____ cfm
Minimum flow _____ cfm

(2) Check damper maximum/minimum flow settings.

Maximum flow setting _____ cfm
Minimum flow setting _____ cfm

Reheat coil operation range (full open to full closed) _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Quality Control Representative	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's Testing, Adjusting and Balancing Representative	_____
Contractor's Controls Representative	_____
Government Representative	_____

Using Agency's Representative _____

Design Agency's Representative _____

Commissioning Specialist _____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: _____

Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

1. Functional Performance Test: Contractor shall verify operation of air handling unit as per specification including the following:

a. The following shall be verified when the supply and return fans operating mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) System safeties allow start if safety conditions are met. _____

(4) VAV fan controller shall "soft-start" fan. _____

(5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the design static pressure Class shown. _____

b. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper at minimum position. _____

(4) Chilled water control valve modulating to maintain leaving air temperature set point. _____

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point. _____

c. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. _____

(2) Relief air damper modulates with outside air damper according to sequence of operation. _____

(3) Chilled water control valve modulating to maintain leaving air temperature set point. _____

(4) Hot water control valve modulating to maintain leaving air temperature set point. _____

(5) Fan VAV controller receiving signal from duct static pressure

sensor and modulating fan to maintain supply duct static pressure set point.

_____

d. Unoccupied mode of operation

(1) All dampers in normal position. _____

(2) Verify low limit space temperature is maintained as specified in sequence of operation. _____

e. The following shall be verified when the supply and return fans off mode is initiated:

(1) All dampers in normal position. _____

(2) All valves in normal position. _____

(3) Fan de-energizes. _____

f. Verify the chilled water coil control valve operation by setting all VAV's to maximum and minimum cooling.

	Max cooling	Min cooling
Supply air volume _____ cfm)	_____	_____
Supply air temp. (_____ degrees F)	_____	_____

g. Verify safety shut down initiated by smoke detectors. _____

h. Verify safety shut down initiated by low temperature protection thermostat. _____

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Quality Control Representative _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's Testing, Adjusting and Balancing Representative _____

Contractor's Controls Representative _____

Government Representative _____

Using Agency's Representative _____

Design Agency's Representative _____

Commissioning Specialist _____

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
11/20, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2015; Rev L) Obstruction Marking and Lighting

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

Haul Road Plan; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (60mph or 95 km/hr) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

1.5 CYBERSECURITY DURING CONSTRUCTION

{For Reference Only: This subpart (and its subparts) relates to AC-18, SA-3, CCI-00258.} Meet the following requirements throughout the construction process.

1.5.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.5.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.5.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

1.5.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.5.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company.

1.5.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.5.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

1.5.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification.

1.5.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.5.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.5.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Within 30 calendar days of mobilization on site and prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26.00 06 GOVERNMENTAL SAFETY REQUIREMENTS.

2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as indicated. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1.

2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 6 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Equip fence with a lockable gate. Gate must remain locked when construction personnel are not present.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Employee parking must not interfere with existing and established parking requirements of the Government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.2.3 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 30 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer.

3.4 CONTRACTOR'S TEMPORARY FACILITIES

Temporary facilities must meet requirements as identified in EM 385-1-1 Section 04.

3.4.1 Quality Control Manager Records and Field Office

Provide on the jobsite an office with approximately 200 square feet of useful floor area for the exclusive use of the QC Manager. Provide a weathertight structure with adequate heating and cooling, toilet facilities, lighting, ventilation, a 4 by 8 foot plan table, a standard size office desk and chair, computer station, and working communications facilities. Provide either a 1,500 watt radiant heater and a window-mounted air conditioner rated at 9,000 Btus minimum or a window-mounted heat pump of the same minimum heating and cooling ratings. Provide a door with a cylinder lock and windows with locking hardware. Make utility connections. Locate as directed. File quality control records in the office and make available at all times to the Government. After completion of the work, remove the entire structure from the site.

3.4.2 Safety Systems

Protect the integrity of any installed safety systems or personnel safety devices. Obtain prior approval from Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.4.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored green, so that

visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.4.4 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.4.5 Appearance of Trailers

a. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.

b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

3.4.6 Maintenance of Storage Area

a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

b. Cut grass (or annual weeds) within the construction and storage sites to a maximum 4 inch height at least once a week during the growing season, whether or not area is visible to the public to assist in rodent control. Trim the grass around fences at time of grass cutting. Maintain grass or weeds on stockpiled earth as descried above.

3.4.7 Security Provisions

Provide adequate outside security lighting at the temporary facilities. The Contractor will be responsible for the security of its own equipment.

3.4.8 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.4.8.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.5 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

3.6 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.7 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
02/19, CHG 1: 08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 273	Standards for Universal Waste Management
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

1.2.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

1.2.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

1.2.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

1.2.5 Diversion

The practice of diverting waste from disposal in a landfill, by means of eliminating or minimizing waste, or reuse of materials.

1.2.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying

constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

1.2.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

1.2.8 Reuse

The use of a product or materials again for the same purpose, in its original form or with little enhancement or change.

1.2.9 Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

1.2.10 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

1.3 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project construction waste and demolition debris/waste from the landfill. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

1.4 CONSTRUCTION WASTE MANAGEMENT

Implement a construction waste management program for the project. Take a pro-active, responsible role in the management of construction construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the construction waste management program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

1.4.1 Implementation of Construction Waste Management Program

Develop and document how the construction waste management program will be implemented in a construction waste management plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to

provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

1.4.2 Special Programs

Implement any special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

1.4.3 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

1.4.4 Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the construction waste management plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste steams not listed:

a. Land Clearing Debris

b. Asphalt

c. Masonry and CMU

d. Concrete

e. Metals (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze, etc.)

f. Wood (nails and staples allowed)

g. Glass

h. Paper

i. Plastics (PET, HDPE,PVC,LDPE,PP,PS, Other)

j. Gypsum

k. Non-hazardous paint and paint cans

l. Carpet

m. Ceiling Tiles

n. Insulation

o. Beverage Containers

1.5 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan; G

SD-06 Test Reports

Quarterly Reports

Annual Report

SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

1.6 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed construction waste management plan and to develop a mutual understanding relative to the management of the construction waste management program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 04.10 06 CONTRACTOR QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

a. Pre-demolition meeting.

b. Regular Quality Control meetings.

c. Work safety meeting (if applicable).

1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15 calendar days after notice to proceed. Revise and resubmit Construction Waste Management Plan until it receives final approval from the Contracting Officer, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION AND DECONSTRUCTION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved construction waste management plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on the project..

b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.

e. Name of landfill and/or incinerator to be used.

f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.

g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.

h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.

i. Description of the means by which any materials identified in item (g) above will be protected from contamination.

j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.

l. Identification of at least 5 construction or demolition material streams for diversion.

m. Detailed plan and distribution of waste diversion between buildings, when project is a part of a campus.

n. Facilities or subcontractors offering construction waste transport on-site or off-site must ensure that proper shipping orders, bill of lading, manifests, or other shipping documents containing waste diversion information meet requirements of 40 CFR 273 Universal Waste Management, 49 CFR 173 Shippers - General Requirements for Shipments and Packagings, and 49 CFR 178 Specifications for Packaging. Individuals signing manifests or other shipping documents should meet the minimum training requirements.

o. List each supplier who deliver construction materials, in bulk, or package products in returnable containers or returnable packaging, or have take-back programs. List each program and the applicable material to actively monitor and track to assist in meeting waste diversion requirements on the project.

p. Identify any local jurisdiction requirements for waste management. Include those requirements, points of contact, etc.

Distribute copies of the waste management plan to each subcontractor, Quality Control Manager Environmental Manager, and the Contracting Officer.

1.8 RECORDS (DOCUMENTATION)

1.8.1 General

Maintain records to document the types and quantities of waste generated and diverted though re-use, recycling and/or sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for any materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

1.8.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

1.9 REPORTS

1.9.1 General

Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for the project. Reports must identify quantifies of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

1.9.2 Quarterly Reporting

Provide cumulative reports at the end of each quarter (December, March, June, and September, corresponding with the federal fiscal year for reporting purposes). Submit quarterly reports not later than 15 calendar days after the preceding quarter has ended. Submit Quarterly Reports to the appropriate office or identified point of contact.

1.9.3 Annual Reporting

Provide a cumulative construction waste diversion report annually. Submit

annual report not later than 30 calendar days after the preceding fourth quarter has ended. Provide copy of annual construction waste diversion report to the installation POC.

1.10 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide Final Construction Waste Diversion Report 60 days prior to the Beneficial Occupancy Date (BOD).

1.11 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the construction waste management plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 35 43 GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS (WPAFB). Separate materials by one of the following methods described herein:

1.11.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the construction waste management plan.

1.11.2 Co-Mingled Method

Place waste products and recyclable materials into a single container and then transport to an authorized recycling facility, which meets all applicable requirements to accept and dispose of recyclable materials in accordance with all applicable local, state and federal regulations. The Co-mingled materials must be sorted and processed in accordance with the approved construction waste management plan.

1.11.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.12 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the

following:

1.12.1 Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved construction waste management plan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is allowed on the Installation.

1.12.2 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

1.12.3 Compost

Consider composting on site if a reasonable amount of compostable materials will be available and a utilization of compostable material can be determined and appropriately planned for. Compostable materials include plant materials, sawdust and certain food scraps. Composting as a strategy must be explicitly addressed in the Construction Waste Management Plan submitted for approval to ensure it is feasible.

1.12.4 Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used. -- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
08/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database ; G

Training Plan; G

Training Outline; G

Training Content; G

SD-11 Closeout Submittals

Training Video Recording; G

Validation of Training Completion; G

1.3 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.3.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be

consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.3.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Use Data Package 4 for commissioned items without a specified data package requirement in the individual technical sections. Provide a Data Package 5 instead of Data Package 1 or 2, as specified in the individual technical section, for items that are commissioned.

1.3.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

1.3.4 Commissioning Authority Review and Approval

Submit the commissioned systems and equipment submittals to the Commissioning Authority (CxA) to review for completeness and applicability. Obtain validation from the CxA that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CxA communicates deficiencies to the Contracting Officer. Submit the O&M manuals to the Contracting Officer upon a successful review of the corrections, and with the CxA recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal review procedures for O&M data.

1.4 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.5 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

1.5.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

1.5.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

a. Building Number

b. Project Title

c. Activity and Location

d. Construction Contract Number

e. Prepared For: (Contracting Agency)

f. Prepared By: (Name, title, phone number and email address)

g. Include the disk content on the disk label

h. Date

i. Virus scanning program used

1.6 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

1.6.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.6.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26.00 06 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

1.6.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.6.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.6.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.6.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.6.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.6.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).

d. Full points list. Provide a listing of rooms with the following information for each room:

(1) Floor

(2) Room number

(3) Room name

(4) Air handler unit ID

(5) Reference drawing number

(6) Air terminal unit tag ID

(7) Heating or cooling valve tag ID

(8) Minimum cfm

(9) Maximum cfm

e. Full print out of all schedules and set points after testing and acceptance of the system.

f. Full as-built print out of software program.

g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.6.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.6.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for

preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

1.6.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.6.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.6.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.6.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.6.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.6.4 Real Property Equipment

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Submit the final list 30 days after transfer of the completed facility.

Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.6.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.6.5.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

1.6.5.2 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

1.6.5.3 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

1.6.5.4 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and

exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.6.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system.

1.6.5.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid.

1.6.5.7 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.6.5.8 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.5.9 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.5.10 Field Test Reports

Provide a copy of Field Test Reports (SD-06) submittals documented with the required approval.

1.6.5.11 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

1.7.1 Data Package 1

a. Safety precautions and hazards

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Extended warranty information

f. Contractor information

g. Spare parts and supply list

1.7.2 Data Package 2

a. Safety precautions and hazards

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan, schedule, and procedures

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Extended warranty information

m. Contractor information

1.7.3 Data Package 3

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Operating log

h. Lubrication data

i. Preventive maintenance plan, schedule, and procedures

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Product submittal data

q. O&M submittal data

r. Parts identification

s. Warranty information

t. Extended warranty information

u. Testing equipment and special tool information

v. Testing and performance data

w. Contractor information

x. Field test reports

1.7.4 Data Package 4

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Operating log

i. Lubrication data

j. Preventive maintenance plan, schedule, and procedures

k. Cleaning recommendations

l. Troubleshooting guides and diagnostic techniques

m. Wiring diagrams and control diagrams

n. Repair procedures

o. Removal and replacement instructions

p. Spare parts and supply list

q. Repair work-hours

r. Product submittal data

s. O&M submittal data

t. Parts identification

u. Warranty information

v. Extended warranty information

w. Personnel training requirements

x. Testing equipment and special tool information

y. Testing and performance data

z. Contractor information

aa. Field test reports

1.7.5 Data Package 5

a. Safety precautions and hazards

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan, schedule, and procedures

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Extended warranty information

s. Testing and performance data

t. Contractor information

u. Field test reports

v. Additional requirements for HVAC control systems

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Substantial Completion, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the Facilities Management Specialist, building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Commissioning Authority (CxA) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and CxA. Include within the plan the following elements:

a. Equipment included in training

b. Intended audience

c. Location of training

d. Dates of training

e. Objectives

f. Outline of the information to be presented and subjects covered including description

g. Start and finish times and duration of training on each subject

h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)

i. Instructor names and instructor qualifications for each subject

j. List of texts and other materials to be furnished by the Contractor that are required to support training

k. Description of proposed software to be used for video recording of training sessions.

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The CxA is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

b. Relevant health and safety issues.

c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

d. Design intent.

e. Use of O&M Manual Files.

f. Review of control drawings and schematics.

g. Interactions with other systems.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting

Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

3.1.7 Quality Control Coordination

Coordinate this training with the CxA in accordance with 01 45 04.10 06 CONTRACTOR QUALITY CONTROL.

-- End of Section --

SECTION 02 41 00

DEMOLITION AND DECONSTRUCTION
05/10

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 Guideline K	(2015) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145	(1991; R 2008) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	(2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6	(2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

CARPET AND RUG INSTITUTE (CRI)

CRI CIS	(2011) Carpet Installation Standard

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25	(June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M	(2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures

MIL-STD-129	(2014; Rev R) Military Marking for Shipment and Storage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a Demolition Plan Deconstruction Plan and submit proposed deconstruction, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin deconstruction until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the building. The work includes deconstruction, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction,work performed under this contract. Do not overload structural elements and pavements to remain. Provide new supports and reinforcement for existing construction weakened by deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.3.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00

SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions; G

SD-07 Certificates

Deconstruction Plan; G

Notification; G

SD-11 Closeout Submittals

Receipts

1.6 QUALITY ASSURANCE

Submit timely notification of renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA) and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debristo occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolitionanddeconstruction work continuously evaluate the condition of the structure being demolishedandpartly deconstructed and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to

be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

2.1 FILL MATERIAL

a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.

b. Fill material shall conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.

c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Dismantled and removed materials are to be recycled in accordance with specification Section 01 35 43 GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS (WPAFB). The Contractor is to remove material not recycled off site.

3.1.1 Structures

a. Remove existing structures indicated to be removed to depth to remove existing foundation and column footer approximate five feet below grade. Interior walls, other than retaining walls and partitions, shall be removed toto top of concrete slab. Remove sidewalks, curbs, gutters and street light bases as indicated.

b. Demolish interior walls in the building as indicted. Deconstruct structures in a systematic manner from the top of the structure to the ground. Demolish Deconstruct concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means ofsuitable methods as approved by the Contracting Officer.

c. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

d. Building, or the remaining portions thereof, not exceeding 80 feet in height may be demolished by the mechanical method of demolition.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities , as indicatedand terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related items scheduled for removal and transport to designated areas. Remove gates as whole units.

3.1.4 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

3.1.5 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain, to removed materials being salvaged and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

3.1.6 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided

that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.7 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.8 Carpentry

Salvage for recyclelumber, millwork items, and finished boards, and sort by type and size. Remove windows, doors, frames, and cabinets, and similar items as whole units, complete with trim and accessories.

3.1.9 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Adhesive removal solvents shall comply with CRI CIS. Recycle removed carpet cushion.

3.1.10 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, priority shall be given to a local recycling organization. Recycling is not required if the tiles contain or may have been exposed to asbestos material.

3.1.11 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

a. Concrete and Masonry: Completely fill holes and depressions, left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. The

transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.12 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

3.1.13 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.14 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

3.1.15 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated storage area as directed by the Contracting Officer. Do not remove equipment until approved. Do not offer low-efficiency equipment for reuse.

3.1.15.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, shall be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.15.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions

taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for salvage, or not reusable, as scrap metal.

3.1.15.3 Ducts

Classify removed duct work as scrap metal.

3.1.15.4 Fixtures, Motors and Machines

Remove and salvage fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor.

3.1.16 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

3.1.16.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage.

3.1.16.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.16.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.16.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.1.17 Elevators and Hoists

Remove elevators, hoists, and similar conveying equipment and salvage as whole units, to the most practical extent. Remove and prepare items for salvage without damage to any of the various parts. Salvage and store rails for structural steel with the equipment as an integral part of the unit.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for recycled and/or salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.2.2 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g., residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

3.2.2.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

a. Activity name and unit identification code

b. Activity point of contact and phone number

c. Type of ODS and pounds of ODS contained

d. Date of shipment

e. National stock number (for information, call (804) 279-4525).

3.2.3 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.2.4 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable noncombustible material off the site.

3.3 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.4.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.4.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --

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SECTION 04 20 00

UNIT MASONRY
11/15, CHG 2: 05/19

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 CONCRETE INSTITUTE (ACI)

ACI 216.1	(2014) Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A951/A951M	(2011) Standard Specification for Steel Wire for Masonry Joint Reinforcement
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C129	(2017) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	(2019a; E 2019) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2020) Standard Specification for Grout for Masonry

ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C1019	(2019) Standard Test Method for Sampling and Testing Grout
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars

THE MASONRY SOCIETY (TMS)

TMS MSJC	(2016) Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries

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

Hot Weather Procedures

Cold Weather Procedures

Cement

Cementitious Materials

SD-05 Design Data

Fire-Rated Concrete Masonry Units

SD-06 Test Reports

Fire-Rated Concrete Masonry Units

SD-07 Certificates

Concrete Masonry Units (CMU)

Admixtures for Masonry Mortar

Admixtures for Grout

Joint Reinforcement

SD-08 Manufacturer's Instructions

Admixtures for Masonry Mortar

Admixtures for Grout

1.3 QUALITY ASSURANCE

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.4.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS MSJC.

1.4.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

1.5 PROJECT/SITE CONDITIONS

Conform to TMS MSJC for hot and cold weather masonry erection.

1.5.1 Hot Weather Procedures

When ambient air temperature exceeds 100 degrees F, or exceeds 90 degrees F and the wind velocity is greater than 8 mph, comply with TMS MSJC Article 1.8 D for: Preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

1.5.2 Cold Weather Procedures

When ambient temperature is below 40 degrees F, comply with TMS MSJC Article 1.8 C for: Preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry, f'm, is 2,000 psi.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Concrete Units

2.2.2.1 Concrete Masonry Units (CMU)

2.2.2.1.1 Cement

Use only cement that has a low alkali content and is of one brand.

2.2.2.1.2 Size

Provide units with specified dimension of 7-5/8 inches wide, 7-5/8 inches high, and 15-5/8 inches long.

2.2.2.1.3 Surfaces

Provide units with exposed surfaces that are smooth and of uniform texture.

2.2.2.1.4 Unit Types

a. Hollow Non-Load-Bearing Units: ASTM C129, normal weight. Load-bearing units may be provided in lieu of non-load-bearing units.

2.2.2.2 Fire-Rated Concrete Masonry Units

For indicated fire-rated construction, provide concrete masonry units of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated by linear interpolation based on the percent by dry-rodded volume of each aggregate used in manufacturing the units.

TABLE I
FIRE-RATED CONCRETE MASONRY UNITS

Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, inch						
	1/2 hour	3/4 hour	1 hour	1-1/2 hour	2 hours	3 hours	4 hours
Calcareous or siliceous gravel (other than limestone)	2.0	2.4	2.8	3.6	4.2	5.3	6.2
Limestone, cinders, or air-cooled slag	1.9	2.3	2.7	3.4	4.0	5.0	5.9

TABLE I FIRE-RATED CONCRETE MASONRY UNITS							
Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, inch						
Expanded clay, expanded shale, or expanded slate	1.8	2.2	2.6	3.3	3.6	4.4	5.1
Expanded slag or pumice	1.5	1.9	2.1	2.7	3.2	4.0	4.7

Determine equivalent thickness in accordance with ACI 216.1. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; include the thickness of plaster or brick or other material in the assembly in determining the equivalent thickness. Submit calculation results.

2.3 EQUIPMENT

2.3.1 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to ASTM C1384, unless Type III portland cement is used in the mortar.

2.4.1.4 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Admixtures for Grout

Water-reducing admixtures that conform to ASTM C494/C494M Type F or G and viscosity-modifying admixtures that conform to ASTM C494/C494M Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the Contracting Officer; use accelerating admixture that is non-corrosive and conforms to ASTM C494/C494M, Type C.

2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

a. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.

b. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

c. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, fine. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 2000 psi in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

2.6 ACCESSORIES

2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

2.6.2 Anchors, Ties, and Bar Positioners

2.6.2.1 General

a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of 5/8 inch mortar cover from each face of

masonry.

b. Fabricate steel wire anchors and ties from wire conforming to ASTM A1064/A1064M and hot-dip galvanize in accordance with ASTM A153/A153M.

c. Fabricate joint reinforcement in conformance with ASTM A951/A951M. Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in conformance with ASTM A153/A153M. Galvanize joint reinforcement in other interior walls in conformance with ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below.

d. Fabricate sheet metal anchors and ties in conformance with ASTM A1008/A1008M. Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in compliance with ASTM A153/A153M Class B. Galvanize sheet metal anchors and ties in other interior walls in compliance with ASTM A653/A653M, Coating Designation G60.

2.6.2.2 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized. Bar positioners must be suitable for intended use and be corrosion resistant steel. Bar positioners not fully contained within the wythe must be hot-dip galvanized.

2.6.3 Joint Reinforcement

Factory fabricate joint reinforcement in conformance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of 9 gauge. Size joint reinforcement to provide a minimum of 5/8 inch cover from each face. Space crosswires not more than 16 inches. Provide joint reinforcement for straight runs in flat sections not less than 10 feet long. Provide joint reinforcement with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to start of work, verify the applicable conditions as set forth in TMS MSJC, inspection.

3.2 PREPARATION

3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.2.2 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.3 ERECTION

3.3.1 General

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in running bond pattern. Adjust each unit to its final position while mortar is still soft and has plastic consistency.

b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.

c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Toothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint.

d. Ensure that units being laid and surfaces to receive units are free of water film. Lay solid units in a nonfurrowed full bed of mortar. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.

3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed interior masonry surfaces concave, using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint.

3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and on masonry surfaces that are to receive plaster. Finish flush cut joints by cutting off the mortar flush with the face of the wall.

3.3.1.1.3 Joint Widths

a. Provide 3/8 inch wide mortar joints in concrete masonry.

b. Maintain mortar joint widths within tolerances permitted by TMS MSJC.

3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

a. Carefully make openings in the masonry so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.3.2 Reinforced, Single Wythe Concrete Masonry Units Walls

3.3.2.1 Concrete Masonry Unit Placement

a. Fully bed units used to form starting courses on concrete floor and where cells are to be filled with grout in mortar under both face shells and webs. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.

3.4 INSTALLATION

3.4.1 Placing Grout

3.4.1.1 General

Solidly grout all hollow masonry units. Units other than open end units may require grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, tear down the wall and rebuild.

3.4.1.2 Grout Holes and Cleanouts

3.4.1.2.1 Grout Holes

Provide grouting holes in new construction only on corridor side of CMU wall. Provide openings spaced not more than 16 inches on centers where grouting of hollow unit masonry is indicated. Form such openings not less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.4.1.2.2 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout.

Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Provide cleanouts not less than 3 by 3 inch by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes until masonry work and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.1.3 Grout Placement

A grout pour is the total height of masonry to be grouted prior to erection of additional masonry. A grout lift is an increment of grout placement within a grout pour. A grout pour is filled by one or more lifts of grout.

a. Lay masonry to the top of a pour permitted by TMS MSJC Table 7, based on the size of the grout space and the type of grout. Prior to grouting, remove masonry protrusions that extend 1/2 inch or more into cells or spaces to be grouted. Provide grout holes and cleanouts in accordance with paragraph GROUT HOLES AND CLEANOUTS above when the grout pour height exceeds 5 feet 4 inches. Hold reinforcement, bolts, and embedded connections rigidly in position before grouting is started. Do not prewet concrete masonry units.

b. Place grout using a hand bucket, concrete hopper, or grout pump to fill the grout space without segregation of aggregate. Operate grout pumps to produce a continuous stream of grout without air pockets, segregation, or contamination.

c. If the masonry has cured at least 4 hours, grout slump is maintained between 10 to 11 inches, and no intermediate reinforced bond beams are placed between the top and bottom of the pour height, place

conventional grout in lifts not exceeding 12 feet 8 inches. For the same curing and slump conditions but with intermediate bond beams, limit conventional grout lift to the bottom of the lowest bond beam that is more than 5 feet 4 inches above the bottom of the lift, but do not exceed 12 feet 8 inches. If masonry has not cured at least 4 hours or grout slump is not maintained between 10 to 11 inches, place conventional grout in lifts not exceeding 5 feet 4 inches.

d. Consolidate conventional grout lift and reconsolidate after initial settlement before placing next lift. For grout pours that are 12 inches or less in height, consolidate and reconsolidate grout by mechanical vibration or puddling. For grout pours that are greater than 12 inches in height, consolidate and reconsolidate grout by mechanical vibration. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation. If previous lift is not permitted to set, dip vibrator into previous lift. Do not insert vibrators into lower lifts that are in a semi-solidified state. If lower lift sets prior to placement of subsequent lift, form a grout key by terminating grout a minimum of 1-1/2 inch below a mortar joint. Vibrate each vertical cell containing reinforcement in partially grouted masonry. Do not form grout keys within beams.

e. If the masonry has cured 4 hours, place self-consolidating grout (SCG) in lifts not exceeding the pour height. If masonry has not cured for at least 4 hours, place SCG in lifts not exceeding 5 feet 4 inches. Do not mechanically consolidate self-consolidating grout. Place self-consolidating grout in accordance with manufacturer's recommendations.

f. Upon completion of each day's grouting, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.4.2 Joint Reinforcement Installation

Install joint reinforcement at 16 inches on center unless otherwise indicated. Lap joint reinforcement not less than 6 inches. Place the longitudinal wires of joint reinforcement in mortar beds to provide not less than 5/8 inch cover to either face of the unit.

3.5 APPLICATION

3.5.1 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS MSJC, Article 3.3 F.

3.6 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry

surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

3.6.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.7 PROTECTION

Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY
08/16, CHG 2: 11/18

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 B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts
ASME B18.6.1	(2016) Wood Screws (Inch Series)

AMERICAN WOOD COUNCIL (AWC)

AWC WFCM	(2012) Wood Frame Construction Manual for One- and Two-Family Dwellings

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M6	(2013) Brands Used on Preservative Treated Materials
AWPA P49	(2015; R 2021) Standard for Fire Retardant FR-1
AWPA T1	(2021) Use Category System: Processing and Treatment Standard
AWPA U1	(2021) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel

	Hardware
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM D2898	(2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)	
CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
GREEN SEAL (GS)	
GS-36	(2013) Adhesives for Commercial Use
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)	
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
CID A-A-1923	(Rev A; Notice 3) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 3) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors
CID A-A-1925	(Rev A; Notice 3) Shield Expansion (Nail Anchors)
UNDERWRITERS LABORATORIES (UL)	
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

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

Fire-retardant Treatment

Adhesives

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870. Surfaces that are to be exposed to view must not bear grademarks or other types of identifying marks.

1.4.2 Fire-Retardant Treated Lumber

Mark each piece in accordance with AWPA M6, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6.

1.5 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to AWPA P49. Fire retardant treatment of wood products must conform to the requirements of AWPA U1, Commodity Specification H and AWPA T1, Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with ASTM D2898 prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and formaldehyde.

1.6 QUALITY ASSURANCE

1.6.1 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and

control humidity.

1.7 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

1.8 CERTIFICATIONS

1.8.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.8.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

PART 2 PRODUCTS

2.1 PLYWOOD

APA L870.

2.1.1 Other Uses

2.1.1.1 Plywood

Plywood for backing of wall-hung equipment. 3/4 inch thick, C-D Grade, Exposure 1, and fire-retardant treated in accordance with AWPA M6.

2.2 OTHER MATERIALS

2.2.1 Miscellaneous Wood Members

2.2.1.1 Blocking

Blocking must be standard or number 2 grade, and fire-retardant treated in accordance with AWPA P49.

2.2.2 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36.

2.3 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials must be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs must be hot-dip zinc-coated in accordance with ASTM A153/A153M. Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.

2.3.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.3.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.3.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices must be 3/8 inch.

2.3.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.3.5 Wood Screws

ASME B18.6.1.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Conform to AWC WFCM unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner.

3.2 MISCELLANEOUS

3.2.1 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

3.2.2 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or

other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

-- End of Section --

SECTION 07 21 16

MINERAL FIBER BLANKET INSULATION
11/11, CHG 4: 08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

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

Blanket Insulation

Accessories

SD-08 Manufacturer's Instructions

Insulation

1.3 CERTIFICATIONS

Submit required indoor air quality certifications and validations in one submittal package.

1.3.1 Insulation Products

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

1.3.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E84. This specification to include sound attenuation batt insulation.

2.1.1 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Fiberglass: 20 percent glass cullet complying with ASTM D5359.

2.1.2 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E136 for blocking around chimneys and heat producing devices.

2.3 ACCESSORIES

2.3.1 Adhesive

As recommended by the insulation manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36.

2.3.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.3.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between studs and other framing, such as door heads, jambs, and headers.

3.3.1.5 Sizing of Blankets

Provide only full width blankets when insulating between studs. Size width of blankets for a snug fit where studs are irregularly spaced.

-- End of Section --

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SECTION 07 84 00

FIRESTOPPING
05/10, CHG 1: 08/13

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.

b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

c. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E699	(2009) Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
ASTM E814	(2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E1399/E1399M	(1997; R 2017) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015; R 2019) Standard Test Method for Fire-Resistive Joint Systems

ASTM E2174	(2020a) Standard Practice for On-Site Inspection of Installed Firestop Systems
ASTM E2307	(2020) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2020a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

FM GLOBAL (FM)

FM 4991	(2013) Approval of Firestop Contractors
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1479	(2015; Reprint May 2021) Fire Tests of Through-Penetration Firestops
UL 2079	(2015; Reprint Jul 2020) Tests for Fire Resistance of Building Joint Systems
UL Fire Resistance	(2014) Fire Resistance Directory

1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G

SD-03 Product Data

Firestopping Materials; G

SD-06 Test Reports

Inspection

SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer and submit written certification of training, and retain proof of certification for duration of firestop installation.

1.5.2 Inspector Qualifications

The inspector shall meet the criteria contained in ASTM E699 for agencies involved in quality assurance and shall have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the Contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

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

2.2.1 Fire Hazard Classification

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

2.2.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

2.2.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = Rating of wall or partition being penetrated.

2.2.3.1.2 Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the Ceiling Membrane of Roof-Ceiling Assemblies

F Rating = At least one hour but not less than the fire resistance rating of the construction penetrated. T Rating = At least one hour but not less than the fire resistance rating of the construction penetrated. Where the penetrating item is outside of a wall cavity the F rating must be equal to the fire resistance rating of the floor penetrated, and the T rating must be in accordance with the requirements of ICC IBC.

2.2.3.1.3 Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = At least one hour but not less than the fire resistance rating of the construction penetrated. T Rating = At least one hour but not less than the fire resistance rating of the construction penetrated and L rating = <10 cfm/sf where L rating is required.

2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399/E1399M or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or

metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 30 00 HVAC AIR DISTRIBUTION. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products and devices as indicated.

3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining

the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf measured at ambient temperature and 400 degrees F at 0 percent to 100 percent visual fill.

3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Contracting Officer. The inspector must inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.1 Inspection Standards

Inspect all firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section --

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SECTION 07 92 00

JOINT SEALANTS
08/16, CHG 3: 11/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2021) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2015; R 2019) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2022) Standard Practice for Use of Sealants in Acoustical Applications
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1311	(2014) Standard Specification for Solvent Release Agents
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
ASTM D217	(2019b) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D2452	(2015; R 2019) Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
ASTM D2453	(2015; R 2020; E 2020) Standard Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

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

Sealants

Primers

Bond Breakers

Backstops

SD-06 Test Reports

Field Adhesion

1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

1.4 CERTIFICATIONS

1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.4.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by

UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.6 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding 90 degrees F or lower than 0 degrees F. Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

1.7 QUALITY ASSURANCE

1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application. Perform a pre-construction test on project specific substrates to confirm compatibility.

1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.7.3 Mock-Up

Provide a mock-up of each type of sealant using materials, colors, and techniques approved for use on the project. Approved mock-ups may be incorporated into the Work.

1.7.4 Adhesion

Provide in accordance with ASTM C1193 or ASTM C1521.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

In areas with ambient temperatures that exceed 110 degrees F, do not use polybutene, bituminous, acrylic-latex, polyvinyl acetate latex sealants, polychloroprene (neoprene), polyvinyl chloride (PVC), and polyurethane foams, and neoprene, PVC, and styrene butadiene rubber extruded seals and

closure strips due to these materials having maximum recommended surface temperature ranges from 130 to 180 degrees F.

2.1.1 Interior Sealants

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options.

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent door frames, built-in or surface mounted equipment and fixtures, and similar items.	As selected
b. Joints between edge members for acoustical tile and adjoining vertical surfaces.	As selected
c. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	As selected
d. Behind escutcheon plates at valve pipe penetrations.	As selected

2.1.2 Exterior Sealants

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of louvers and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Voids where items pass through exterior walls.	Match adjacent surface color

2.1.3 Acoustical Sealants

Rubber or polymer based acoustical sealant in accordance with ASTM C919 to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Provide non-staining

acoustical sealant with a consistency of 250 to 310 when tested in accordance with ASTM D217. Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168.

2.1.4 Preformed Sealants

Provide preformed sealants of polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealants capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, sealants must be non-bleeding and have no loss of adhesion.

2.1.4.1 Tape

Tape sealant: Provide cross section dimensions as required to fully seal joint.

2.1.4.2 Bead

Bead sealant: Provide cross section dimensions as required to fully seal joint.

2.1.4.3 Foam Strip

Provide closed cell foam strip of polyurethane foam with cross section dimensions as required to fully seal joint. Provide foam strip capable of sealing out moisture, air, and dust when installed and compressed in accordance with manufacturer's printed instructions. Service temperature must be minus 40 to plus 275 degrees F. Furnish untreated strips with adhesive to hold them in place. Do not allow adhesive to stain or bleed onto adjacent finishes. Saturate treated strips with butylene waterproofing or impregnate with asphalt.

2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with

sealant. Do not use oakum, open cell materials, or other types of absorptive materials as backstops.

2.4.1 Rubber

Provide in accordance with ASTM D1056, Type 2, closed cell, Class A, Grade 2, round cross section for cellular rubber sponge backing.

2.4.2 Synthetic Rubber

Provide in accordance with ASTM C509, Option I, Type II preformed rods for synthetic rubber backing.

2.4.3 Neoprene

Provide in accordance with ASTM D1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 neoprene backing.

2.4.4 Butyl Rubber Based

Provide in accordance with ASTM C1311, from a single component, with solvent release. Color as selected from manufacturer's full range of color choices.

2.4.5 Silicone Rubber Base

Provide in accordance with ASTM C920, from a single component, with solvent release, Non-sag, Type S, Grade NS, Class 35. Color as selected from manufacturer's full range of color choices.

2.5 CAULKING

For interior use and only where there is little or no anticipated joint movement. Provide in accordance with ASTM D2452 and ASTM D2453, oil and resin-based caulking. Provide products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168.

2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. Protect adjacent aluminum and bronze surfaces from solvents. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and ASTM C1193, Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken. For each different sealant and substrate combination, allow for one test every 100 feet in the first

1,000 linear feet. If any failures occur in the first 1,000 linear feet, continue testing at frequency of one test per 500 linear feet.

When installing multi-component joint sealants, inspect that backing material has been properly installed prior to the application of sealant.

3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

3.2.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.2.4 Wood Surfaces

Ensure wood surfaces that will be in contact with sealants are free of splinters, sawdust and other loose particles.

3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry, stone, or brick:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

3.4.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

3.4.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

3.4.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

3.4.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

3.4.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

3.5 PROTECTION AND CLEANING

3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

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SECTION 08 11 13

STEEL DOORS AND FRAMES
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM C578	(2019) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2021) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM D2863	(2019) Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115	(2016) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 105	(2022) Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 113	(2013; R2018) Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies

SDI/DOOR A250.3	(2019) Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
SDI/DOOR A250.6	(2015) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2017) Specifications for Standard Steel Doors and Frames
SDI/DOOR A250.11	(2012) Recommended Erection Instructions for Steel Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2016; Reprint May 2021) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Frames; G

SD-03 Product Data

Doors; G

Frames; G

Accessories

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive

door hardware as specified in Section 08 71 00 DOOR HARDWARE. Undercut where indicated. Provide doors at 1-3/4 inch thick, unless otherwise indicated. Provide door material that uses a minimum of 25 percent recycled content.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Heavy Duty Doors

SDI/DOOR A250.8, Level 2, physical performance Level B, Model 1, with core construction as required by the manufacturer for interior doors of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners must be filled with board insulation. Provide Level 2 for all interior doors.

2.2 INSULATION CORES

Provide insulating cores at all interior doors, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and conforming to:

a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or

b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

c. Mineral board: ASTM C612, Type I.

2.3 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, unless otherwise indicated. Provide frame product that uses a minimum of 25 percent recycled content.

2.3.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.3.2 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated not lighter than 18 gauge.

2.3.2.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

a. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding.

2.3.2.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

2.4 FIRE DOORS AND FRAMES

Provide fire doors and frames in accordance with NFPA 80 and NFPA 105 and this specification. Include insulated core materials in fire doors where indicated in the door schedule.

2.4.1 Labels

Provide fire doors and frames bearing the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing must be in accordance with NFPA 252 or UL 10C. Provide labels that are metal with raised letters, bearing the name or file number of the door and frame manufacturer. Labels must be permanently affixed at the factory to frames and to the hinge edge of the door. Do not paint door and labels.

2.5 HARDWARE PREPARATION

Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Punch door frames, with the exception of frames that will have sound gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.6 FINISHES

2.6.1 Factory-Primed Finish

Thoroughly clean all surfaces of doors and frames then chemically treat and factory prime with a rust inhibiting coating as specified in SDI/DOOR A250.8. Where coating is removed by welding, apply touchup of factory primer.

2.6.2 Factory-Applied Enamel Finish

Provide coatings that meet test procedures and acceptance criteria in accordance with SDI/DOOR A250.3. After factory priming, apply two coats of low-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements must be in accordance with the coating manufacturer's recommendations. Provide finish coat color to match Base standard.

2.7 FABRICATION AND WORKMANSHIP

Provide finished doors and frames that are strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges,

holes, warp, and buckle. Provide molded members that are clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints must be well formed and in true alignment. Conceal fastenings where practicable.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

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SECTION 08 31 00

ACCESS DOORS AND PANELS
05/17, CHG 1: 08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Access Doors And Panels; G

SD-03 Product Data

Access Doors And Panels; G

Hardware Including Locks and Keys; G

Accessories; G

SD-04 Samples

Finishes; G

1.3 MISCELLANEOUS REQUIREMENTS

For access doors and panels provide the following:

1.3.1 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, hardware, accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Provide details of adjoining work for each condition indicated.

1.3.2 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

2.2 MATERIALS

2.2.1 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M.

2.2.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

2.2.3 Stainless Steel

Provide in accordance with ASTM A666, type 302 or 304.

2.2.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.2.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors.

2.2.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with non-removable hinge pins to allow removal of door panel from frame. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for more information.

2.2.7 Locks

Unless otherwise indicated, provide flush screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.

2.2.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

2.3 FABRICATION

2.3.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 24 by 24 inches unless note otherwise in the drawings and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

2.3.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

2.4 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

2.4.1 Recessed Doors

Provide recessed access doors with gypsum wallboard bead flanges. Depth of door panel recess must accommodate the installed thickness of the finish material of the wall assembly for a flush finished condition of the wall and the access panel face. Reinforce panel and frame to prevent sagging.

2.5 FINISHES

Field paint frames and panels to match wall and ceiling surfaces in which they occur. Provide exposed fastenings that approximately match the color and finish of each material to which fastenings are applied.

PART 3 EXECUTION

3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions.

3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

3.5 FIELD PAINTING

Field painting primed access doors in accordance with the requirements of Section 09 90 00 PAINTS AND COATINGS.

3.6 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action.

3.7 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

3.8 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

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SECTION 08 34 73

SOUND CONTROL DOOR ASSEMBLIES
11/19, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A568/A568M	(2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) 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
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C476	(2020) Standard Specification for Grout for Masonry
ASTM D1056	(2020) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D6386	(2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM E90	(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E336	(2020) Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
ASTM E413	(2022) Classification for Rating Sound Insulation
ASTM E1289	(2008; R 2022) Standard Specification for Reference Specimen for Sound Transmission Loss

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Hollow Metal Sound Retardant Doors; G

Door Frames; G

Door Hardware; G

Door Frame Sound Infill; G

Thresholds; G

SD-06 Test Reports

Acoustical Tests; G

SD-07 Certificates

Hollow Metal Sound Retardant Doors

Door Frames

Door Hardware

Thresholds

1.3 QUALITY CONTROL

Ensure work within this section is designed and furnished by one manufacturer, who has been engaged in the manufacture of Sound Retardant Hollow Metal Door systems for at least five years prior to the start of this work.

Provide acoustic assemblies manufactured by a single source specializing in the production of this type work for a minimum of five years.

1.3.1 Compliance and Labeling

1.3.1.1 Compliance with Accessibility Requirements

Americans with Disabilities Act/Architectural Barriers Act (ADA/ABA) 36 CFR 1191.

Accessibility Guidelines for Buildings and Facilities (ADAAG) 36 CFR 1191.

1.4 DELIVERY, STORAGE, AND HANDLING

Ship all doors in the manufacturer's undamaged individual cartons, securely bundled and wrapped with moisture-resistant covers and stored in accordance with the manufacturer's printed instructions in a dry, clean, and ventilated area.

Deliver and store wood doors in the building following the installation of concrete, terrazzo, plaster, or other wet materials, and only after the building has dried out and has a roof.

Store all materials on planks in a dry location. Store doors and frames vertically with minimum 3 inch airspace between. Store doors on the edge to eliminate any potential damage to the door bottom seal. Cover all material to protect from damage but in a manner to allow proper circulation.

Maintain relative humidity in the building between 30 and 65 percent. Maintain the ambient temperature at 60 degrees F minimum at the time of installation of wood doors.

Perform final adjustment of seals when temperatures and humidity conditions replicate the interior conditions that will exist when the building is occupied.

1.5 WARRANTY

Manufacturer's warranty for 5 years from date of supply, covering material and workmanship. Failures include, but are not limited to, the following:

a. Failure to meet sound rating requirements

b. Faulty operation of sound seals

c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound retardant door assemblies of the thickness, width, and height indicated, complete with perimeter seals, seal housings, gasketing, automatic door bottoms, thresholds, and door frames as required to conform to the specified STC per ASTM E90 and ASTM E1289.

Submit fabrication drawings for Hollow Metal Sound Retardant Doors, Door Frames and Door Frame Sound Infill.

Provide assemblies that are complete with metal frame, hollow metal door(s), sealing system, and hinges.

2.1.1 Design Requirements

2.1.1.1 Door Design

Provide sound Retardant Hollow Metal Swinging Doors that are a 1-3/4-inch thickness construction or as required by manufacturer with sizes as indicated on drawings. No visible seams are permitted on door faces. Provide face gauges, internal sound retardant core and perimeter door edge construction per manufacturer's standard for the specified STC rating. No lead or asbestos is permitted in door construction to achieve STC performance. Provide face veneer species cut and color as selected from manufacturer's full range of available colors and patterns. No lead or asbestos is permitted in door construction to achieve performance requirements.

2.1.1.2 Frame Design

Provide sound Retardant Metal Frames conforming to ASTM A1008/A1008M, not less than 0.0747-inch thick, and free from pitting, scale, stretcher strains, fluting, and surface defects with integral trim and shipped with temporary spreader. Knockdown frames are not acceptable.

Provide frames with 2 inch faces, profiles and dimensions as indicated, with mitered reinforced corners, welded the full depth of frame and trim, with exposed surfaces ground smooth and flush. Close contact edges to hairline joints.

2.1.2 Performance Requirements

2.1.2.1 STC (Sound Transmission Classification) Rating

Provide doors with an STC as indicated on the door schedule.

2.2 FABRICATION

Provide doors that are minimum 16 gauge, minimum 1 3/4 inch thick with welded, seamless construction. No visible joints are permitted on the exposed faces or edges. Join door skins at vertical edges by continuous welds, ground and dressed smooth to provide a flush finish. Reinforce top and bottom with 16 gauge continuous inverted steel channels spot welded to both faces. Finish both top and bottom to provide a smooth flush condition. Bevel both vertical edges 1/8 inch in 2 inches.

Clean and sand to smooth finish all doors to remove handling and storage

marks, raised grain, minor surface marks and abrasions which are to receive a job site finish.

2.2.1 Hollow Metal Sound Retardant Doors

2.2.1.1 Construction

Conform to ASTM A1008/A1008M for door construction utilizing steel facing sheets. Conform stretcher level flatness to ASTM A568/A568M; not less than 0.0598 inch thick; free from pitting, scale, and surface defects; separated by a core construction designed to meet the required STC; and tested and rated in accordance with ASTM E90.

Provide doors that have flush seamless face sheets and vertical edges, with continuous welded and smooth joints. Provide edges that are flush or rabbeted as required for perimeter seals.

Provide door surfaces that are visually flat and free from warp, waviness, and other surface irregularities and defects. Maximum allowable warp or twist-can not exceed 1/8 inch when measured with a 7 foot straightedge along the diagonal and not exceed 1/16 inch when measured with a 7 foot straightedge in the width or in any position along the length of the door.

Provide hardware reinforcement that is steel drilled, tapped to template requirements and welded in place. Provide minimum thicknesses as follows:

a. Butts, 0.1494 inch

b. Lock strike, 0.1196 inch

c. Surface applied hardware 0.0747 inch

2.2.1.2 Coating

Thoroughly clean all mill scale, rust, oil, grease, dirt, and other foreign materials from surfaces before the application of the shop coat of paint.

After cleaning, provide galvanized surfaces free of paint in accordance with ASTM D6386, Method A, B, C, or D.

Apply to clean prepared dry surfaces one shop coat of rust inhibitive metallic oxide or synthetic resin primer by brush, dipping, or other approved method to provide a continuous minimum dry film thickness (dft) of 0.9 mil.

Shop paint the exposed door surfaces, including surfaces that are galvanized.

2.3 COMPONENTS

2.3.1 Frames

Construct frames for Sound Retardant Hollow Metal Swinging Doors from formed sheet steel or structural shapes and bars. Provide sheet steel that is commercial quality, level, cold rolled steel conforming to ASTM A1008/A1008Mor hot rolled, pickled and oiled steel conforming to ASTM A1011/A1011M. Comply steel shapes with ASTM A36/A36M and steel bars with ASTM A108, Grade 1018.

2.3.2 Door Frame Sound Infill

Grout: Comply with ASTM C476, with a slump of not more than 4 inches as measured according to ASTM C143/C143M.

Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

Select the appropriate infill material.

2.3.3 Hardware Reinforcements

Factory mortise, reinforce, drill and tap frames for all mortise hardware as required by hardware manufacturer's template. Provide necessary reinforcement plates as required for surface mounted hardware; installer to perform all field drilling and tapping. Provide dust cover boxes on all frame mortises. Provide minimum thicknesses as follows:

a. Butts, 3/16 inch

b. Lock strike, 0.1196 inch

c. Surface applied hardware 0.0747 inch

2.3.4 Jamb Anchors

Provide number and spacing of anchors as follows:

2.3.4.1 Stud-Wall Type

Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

a. Three anchors per jamb up to 60 inches in height.

b. Four anchors per jamb from 60 to 90 inches in height.

c. Five anchors per jamb from 90 to 96 inches in height.

d. Five anchors per jamb plus one additional anchor per jamb for each 24 inches, or fraction thereof, more than 96 inches in height.

e. Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

2.3.5 Door Hardware

Provide the following STC related hardware with the door; heavy weight butt hinges with non-removable pins, perimeter seals, door bottoms, thresholds, and hardware standoff brackets as required.

Include on Fabrication drawings a finish hardware schedule for each door and a hollow metal door frame schedule for each door indicating profile, dimensions, hardware reinforcement, and frame anchorage. Also indicate perimeter seals, door-bottom devices and other hardware items that are assembled in the shop.

Refer to Section 08 71 00 DOOR HARDWARE for remaining hardware requirements.

2.3.6 Head and Jamb Seals

Provide a closed-cell, expanded cellular rubber Seal material conforming to ASTM D1056, Type S, Grade SBE-42 or SCE-42 for heads, jambs.

2.3.7 Door Bottoms

Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.

2.3.7.1 Automatic Door Bottoms

Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

Mounting: As required by testing to achieve STC rating indicated.

2.3.8 Thresholds

Provide flat, smooth, unfluted thresholds as recommended by manufacturer; fabricated from aluminum.

a. Finish: Mill anodic finish.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

2.4.1 Sound Transmission Classification

Provide test reports prepared by a nationally recognized, independent laboratory for Acoustical Tests, Air Infiltration Tests, Wind Loading Tests, and Water Leakage Tests indicating that the sound transmission classification (STC) of the proposed door, based on tests at 16 third-octave band frequencies from 125 to 4,000 hertz, is no less than the specified STC when tested in accordance with ASTM E90, and that the door tested is hung in substantially the type of wall and frame as indicated and is fully operable with hardware and perimeter seals installed.

2.4.2 Guarantee

Provide written guarantee that each door delivered to the project is equal in construction, sound transmission classification (STC), and positive pressure test rating where applicable, with appropriate labeling and markings, to that of the sample door tested. Clearly state in written guarantee that each door assembly, when installed in accordance with the manufacturer's printed instructions, has an in-place STC within 3 decibels of the specimen tested. Submit the following test data and Certificates with the written Guarantee:

a. Acoustical Tests

PART 3 EXECUTION

3.1 PREPARATION

Upon receipt of material, thoroughly inspect all frames, doors and accessories. Verify quantities and tag numbers according to the packing list provided. Report all discrepancies, deficiencies and/or damages immediately to Contracting Officer.

Prior to installation check all doors and frames for correct size and swing. Verify that frames are plumb, square and aligned without twist in accordance with tolerances published by NAAMM/HMMA and SDI.

3.1.1 Frame Painting and Cleaning

Clean thoroughly all surfaces of all mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.

Apply one shop coat of rust inhibitive metallic oxide or synthetic resin primer applied to clean, dry, and prepared surfaces by brush, dipping, or other approved method to provide a continuous minimum dry film thickness of 0.9 mil.

3.2 INSTALLATION

3.2.1 Frame

Install frames plumb and true with not more than 1/32 inch deviation in vertical alignment in 8 feet. Anchor to the wall in accordance with the manufacturer's instructions. Grout frames solid with mortar in masonry, concrete, and plaster wall construction. Spot grout frames in dry wall partitions with mortar at the jamb anchor clips; fill the space between metal frame and stud partition solidly with fiberglass or mineral wool insulation.

Field splices may be required after installation because of shipping limitations. Field weld splices by certified welders per manufacturer's instructions and in accordance with AWS D1.3/D1.3M.

3.2.2 Door

Install and adjust all doors, hardware, and seals in accordance with the approved drawings, hardware schedules, and the printed instructions of the door manufacturer.

Install and adjust perimeter seals and automatic door bottom seals to provide positive compression contact with the entire sealing surface with no gaps, openings, or breaks. Hinges or hardware which distort or pinch the perimeter seal during operation of the door will be rejected.

Install door bottom devices to seal the space between the door bottoms and the finished floor and the space between the seal and seal housing.

Field apply perimeter seal housings with mitered corners and with flush, aligned hairline joints.

Install components to manufacturer's written instructions. Coordinate with wall construction for anchor placement. Set frames plumb, square,

level and at correct elevation. Adjust operable parts for correct clearances and function. Install and adjust perimeter and bottom acoustic seals.

3.3 FIELD QUALITY CONTROL

Provide third party testing in accordance with ASTM E336. Verify in writing that installed product performs no less than five (5) ASTC or NIC rating points below the specified laboratory STC rating. Examine, adjust, and retest any installation not meeting that criteria until compliance is obtained.

3.3.1 Testing and Performance

Provide assemblies that are identical to those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with ASTM E90 and ASTM E413. For the assembly test reports include the laboratory name, test report number and date of test.

-- End of Section --

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SECTION 08 71 00

DOOR HARDWARE
02/16, CHG 4: 02/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
ANSI/BHMA A156.2	(2017) Bored and Preassembled Locks and Latches
ANSI/BHMA A156.3	(2020) Exit Devices
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2020) Cylinder and Input Devices for Locks
ANSI/BHMA A156.6	(2021) Architectural Door Trim
ANSI/BHMA A156.7	(2016) Template Hinge Dimensions
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16	(2018) Auxiliary Hardware
ANSI/BHMA A156.18	(2020) Materials and Finishes
ANSI/BHMA A156.21	(2019) Thresholds
ANSI/BHMA A156.22	(2021) Gasketing
ANSI/BHMA A156.23	(2010) Electromagnetic Locks
ANSI/BHMA A156.25	(2013) Electrified Locking Devices
ANSI/BHMA A156.30	(2014) High Security Cylinders
ANSI/BHMA A156.31	(2013) Electric Strikes and Frame Mounted Actuators
ANSI/BHMA A156.36	(2010) Auxiliary Locks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)

	National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8	(2017) Specifications for Standard Steel Doors and Frames

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(updated continuously online) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Manufacturer's Detail Drawings; G

Verification of Existing Conditions; G

Hardware Schedule; G

Keying System; G

SD-03 Product Data

Hardware Items; G

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G

SD-11 Closeout Submittals

Key Bitting

1.3 SHOP DRAWINGS

Submit manufacturer's detail drawings indicating all hardware assembly components and interface with adjacent construction. Indicate power components and wiring coordination for electrified hardware. Base shop drawings on verified field measurements and include verification of existing conditions.

1.3.1 Wiring Diagrams

Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

b. Complete (risers, point-to-point) access control system block wiring diagrams.

c. Wiring instructions for each electronic component scheduled herein.

1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by 36 CFR 1191 Appendix D - Technical.

1.5 HARDWARE SCHEDULE

Provide Hardware Item List and Hardware Schedule containing the following information, and additional information as needed to identify the complete make up of each hardware set and its application to each opening:

1.5.1 Hardware Item List:

a. Hardware Type

b. Item Number

c. Quantity

d. Size(s)

e. Reference Publication / Type Number

f. Manufacturer's Name / Catalog Number

g. Key Control Symbols

h. UL Mark (If fire rated and listed)

i. BHMA Finish(es)

j. Remarks

1.5.2 Hardware Schedule

a. Hardware Set Number

b. Opening Number(s)

c. Opening Description (single/double leaf, hand, size, door/frame material)

d. Fire Rating

e. Sound Rating

f. Hardware Items

g. Quantity

h. Size

i. BHMA Finish

j. Remarks

In addition, submit hardware schedule data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 KEY BITTING CHART REQUIREMENTS

1.6.1 Requirements

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (e.g., AA1 and AA2).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.7 QUALITY ASSURANCE

1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail unless otherwise directed in key shop drawings coordination meeting. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware applied to metal or to prefinished doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, NFPA 252 for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE. Provide Underwriters Laboratories, Inc. labels for such hardware in accordance with UL Bld Mat Dir or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Coordinate electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.1 Hinges

Provide in accordance with ANSI/BHMA A156.1. Provide hinges that are 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may be provided in lieu of ball bearing hinges.

2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not

less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to fit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Provide levers and roses of mortise locks with screwless shanks and no exposed screws.

2.3.2.2 Auxiliary Locks

Provide in accordance with ANSI/BHMA A156.36, Grade 1.

2.3.2.3 Combination Locks

Heavy-duty, mechanical combination lockset with five push buttons, standard sized, 3/4 inch deadlocking latch, 2-3/4 inch backset. Locks to operate by pressing two or more of the buttons in unison or individually in the proper sequence. Inside operates the latch. Provide a keyed cylinder on the interior to permit setting the combination. Provide a keyed removable core cylinder on the exterior to permit bypassing the combination.

2.3.3 Exit Devices

Provide in accordance with ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms.

Use stainless steel or bronze base metal with plated finishes. Also include stainless steel fasteners and screws.

2.3.4 Cylinders and Cores

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

2.3.4.1 High Security Cylinders

Provide in accordance with ANSI/BHMA A156.30, security level A for all high security cylinder components.

2.3.5 Electrified Hardware

Comply with the requirements of NFPA 70 for wiring of electrified hardware.

2.3.5.1 Electric Strikes and Frame Mounted Actuators

Provide in accordance with ANSI/BHMA A156.31, Grade 1. Provide electric strikes and actuators as required to meet operational requirements. Provide electric strikes that remain secure during power failure. Provide battery backup for continued operation during power failure. Provide strikes and actuators with a minimum opening force of 2300 pounds.

Provide facility interface devices that use direct current (dc) power to energize the solenoids. Provide electric strikes and actuators that

incorporate end-of-line resistors to facilitate line supervision by the system. If not incorporated into the electric strike or local controller, provide metal oxide resistors (MOVs) to protect the controller from reverse current surges.

2.3.5.1.1 Solenoid

Provide actuating solenoid for strikes and actuators that are rated for continuous duty, cannot dissipate more than 12 Watts and must operate on 12 or 24 Volts dc. Inrush current cannot exceed 1 ampere and the holding current cannot be greater than 500 milliamperes. Actuating solenoid must move from fully secure to fully open positions in less than 500 milliseconds.

2.3.5.1.2 Signal Switches

Provide strikes and actuators with signal switches to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. Signal switches must report a forced entry to the system.

2.3.5.1.3 Tamper Resistance

Provide strike guards that prevent tampering with the latch bolt of the locking hardware or the latch bolt keeper of the electric strike. Strike guards to bolt through the door using tamper resistant screws. Provide strike guards made of 1/8 inch thick brass and that are 11-1/14 inch high by 1-5/8 inch wide, with a minimum 5/32 inch wide offset.

2.3.5.1.4 Coordination

Provide electric strikes and actuators of a size, weight and profile compatible with each specified door frame. Field verify installation clearances prior to procurement.

2.3.5.1.5 Mounting Method

Provide electric strikes and actuators suitable for use with single and double doors, with mortise or rim type hardware specified, and for right or left hand mounting as specified. In double door installations, locate the lock in the active leaf and monitor the fixed leaf.

2.3.5.2 Electrified Mortise Locks

Provide in accordance with ANSI/BHMA A156.25, Grade 1. Provide electrified mortise locks that remain secure during power failure. Provide facility interface devices that use dc power to energize solenoids. Provide solenoids, resisters, and signal switches in accordance with paragraph ELECTRIC STRIKES AND FRAME MOUNTED ACTUATORS.

2.3.5.2.1 Power Transfer Hinges

Provide power transfer hinges with each electrified lock that route power and monitoring signals from the lockset to the door frame. Coordinate power transfer hinges with door frames.

2.3.5.3 Release Devices

2.3.5.3.1 Release Devices

Provide wall mounted Electromagnetic release devices connected to fire detecting devices.

2.3.5.4 Electromagnetic Locks

Provide in accordance with ANSI/BHMA A156.23, Grade 1. Provide electromagnetic locks that do not contain any moving parts and depend solely upon electromagnetism to secure a portal by generating at least 1200 pounds of holding force. The lock must interface with the local processors without external, internal or functional alteration of the local processor. The electromagnetic lock must incorporate an end of line resistor to facilitate line supervision by the system. Provide metal-oxide resistors (MOVs) to protect controllers from reverse current surges, if not incorporated into the electromagnetic lock or local controller.

2.3.5.4.1 Mounting Method

Provide electromagnetic lock suitable for use with single and double door with mortise or rim type hardware and compatible with right or left hand mounting.

2.3.6 Keying System

Provide an extension of the existing keying system. Provide construction interchangeable cores. Provide key cabinet as specified.

2.3.7 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

2.3.7.1 Levers and Roses

Provide in accordance with ANSI/BHMA A156.2 and ANSI/BHMA A156.13 for levers, roses, and escutcheons. For unreinforced levers, roses, and escutcheons, provide a 0.050 inch thickness. For reinforced levers, roses, and escutcheons, provide an outer shell thickness of 0.035 inch and a combined total thickness of 0.070 inch, except at lever shanks. Provide lever shanks 0.060 inch thick.

2.3.7.2 Lever Handles

Provide lever handles. Provide in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

2.3.8 Keys

Provide one file key, one duplicate key, and one working key for each key change. Provide 4 great grand master keys, 6 construction master keys, and 4 control keys for removable cores. Provide a quantity of key blanks

equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room number on keys.

2.3.9 Closers

Provide in accordance with ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.3.9.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

2.3.10 Overhead Holders

Provide in accordance with ANSI/BHMA A156.8.

2.3.11 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

2.3.11.1 Sizes of Kick Plates

2 inch less than door width for single doors; 1 inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors.

2.3.12 Door Stops and Silencers

Provide in accordance with ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.13 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.14 Soundproofing Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads,jambs and automatic door bottoms in accordance with the hardware set, of extruded aluminum, clear (natural) anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

2.3.15 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

2.5 FINISHES

Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish except where BHMA 630 is specified under paragraph HARDWARE SETS. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with ANSI/BHMA A156.5, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

PART 3 EXECUTION

3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

3.1.2 Soundproofing Installation

Provide as specified for stop applied weatherstripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves. For aluminum thresholds placed on top of concrete surfaces, coat the underside

surfaces that are in contact with the concrete with fluid applied waterproofing as a separation measure prior to placement.

3.2 FIRE DOORS AND EXIT DOORS

Provide hardware in accordance with NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, and NFPA 252 for fire tests of door assemblies.

3.3 HARDWARE LOCATIONS

Provide in accordance with SDI/DOOR A250.8, unless indicated or specified otherwise.

a. Kick Plates: Push side of single-acting doors.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where directed. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Provide complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Refer to sheet A-601_5 for hardware sets.

-- End of Section --

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SECTION 09 06 00

SCHEDULES FOR FINISHES
05/09, CHG 1: 11/13

PART 1 GENERAL

1.1 SUMMARY

This section covers only the color of exterior and interior materials and products that are exposed to view in the finished construction. The word "color", as used herein, includes surface color and pattern. Requirements for quality, product specifications, and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings if not identified in this specification. Items not designated for color in this section may be specified in other sections. When color is not designated for items, propose a color for approval.

PART 2 PRODUCTS

2.1 COLOR SCHEDULE

The color schedule information provided in the following paragraphs lists the colors, patterns and textures required for interior finishes, including field applied colors. Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers. In the case of difference between the drawings and specifications, colors identified in this specification govern.

2.2 INTERIOR FINISHES

2.2.1 Interior Floor Finishes

Provide flooring materials to match the colors listed below.

2.2.1.1 Carpet Tile

CPT-1: Shaw Contract 24" X 24", Disperse 5T184- Magnetic Fields

2.2.1.2 Resinous Flooring

Sherwin Williams, 2 coat low VOC epoxy paint with silicon sand additive, color match to SW4031 Structural Gray

2.2.2 Interior Base Finishes

Provide base materials to match the colors listed below.

2.2.2.1 Resilient Base and Moldings

RB-1: Roppe 4" Cove Base, Black-Brown

2.2.3 Interior Wall Finishes

Apply interior wall color to the entire wall surface, including reveals,

vertical furred spaces and columns, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Paint items not specified in other paragraphs to match adjacent wall surface. Provide wall materials to match the colors listed below.

2.2.3.1 Paint

PA-1: Sherwin Williams, SW7649 Silverplate, Eggshell

2.2.3.2 Acoustical Wall Covering

AP-1: Carnegie, Xorel-Havana 6249, N0.5

2.2.4 Interior Ceiling Finishes

Apply ceiling colors to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. In addition, apply ceiling color to joists, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted. Provide ceiling materials to match the colors listed below.

2.2.4.1 Acoustical Tile and Grid

ACT-1: Armstrong 24" X 48" Tile, Fine Fissured 1714

2.2.5 Interior Trim

Provide interior trim to match the colors listed below.

2.2.5.1 Steel Door Frames

PA-2: Benjamin Moore 2134-30, Iron Mountain, Semi-Gloss

2.2.5.2 Wood Doors

Match existing building finish.

2.2.6 Interior Miscellaneous

Provide miscellaneous items to match the colors listed below.

2.2.6.1 Corner Guards

CG-1: Construction Specialties, Acrovyn SM-20, 927 Folkstone

2.2.6.2 Signage Message Color

Match to PA-1

2.2.6.3 Signage Background Color

Match to PA-2

2.2.6.4 Wall Switch Handles and Standard Receptacle Bodies

Gray

2.2.6.5 Electrical Device Cover Plates

Stainless Steel

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD
02/10, CHG 2: 08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M	(2015; R 2020; E 2020) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C645	(2014; E 2015) Nonstructural Steel Framing Members
ASTM C754	(2020) Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Support Systems

Submit for the erection of metal framing. Indicate materials, sizes, thicknesses, and fastenings.

SD-03 Product Data

Metal Support Systems

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations permitting easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials

carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Gypsum Wallboard

2.1.1.1 Non-load Bearing Wall Framing and Furring

ASTM C645, but not thinner than 0.0329 inch thickness regardless of the ASTM certified third party testing statement for equivalent thicknesses.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Gypsum Wallboard

3.1.1.1 Non-load Bearing Wall Framing and Furring

ASTM C754, except as indicated otherwise.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

a. Layout of walls and partitions: 1/4 inch from intended position;

b. Plates and runners: 1/4 inch in 8 feet from a straight line;

c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and

d. Face of framing members: 1/4 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09 23 00

GYPSUM PLASTERING
08/16, CHG 1: 11/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C28/C28M	(2010) Gypsum Plasters
ASTM C35	(2001; R 2019) Inorganic Aggregates for Use in Gypsum Plaster
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C631	(2009; R 2020) Bonding Compounds for Interior Gypsum Plastering
ASTM C842	(2005; R 2021) Standard Specification for Application of Interior Gypsum Plaster

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

Gypsum Base Coat Plaster

Gypsum Finish Coat Plaster

SD-04 Samples

Sample Panel; G

Submit three 8 inch by 8 inch square panels of varying texture for the Contracting Officer's approval.

SD-08 Manufacturer's Instructions

Ready-Mix Gypsum Plaster

Submit manufacturer's printed mixing instructions for ready-mix plaster.

1.3 QUALITY ASSURANCE

1.3.1 Sample Panels

Erect sample panel at the building site, or as otherwise directed. Finished gypsum plaster work must match the approved sample panel.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver manufactured materials in the manufacturers' original unbroken packages or containers which are labeled plainly with the manufacturers' names and brands. Keep cementitious materials dry and stored off the ground, under cover, and away from sweating walls and other damp surfaces until ready for use. Keep materials wrapped and separate from off-gassing materials, such as paints and adhesives. Do not use materials that have visible moisture or biological growth.

1.5 SCHEDULING AND ENVIRONMENTAL REQUIREMENTS

The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the plaster. If the mechanical system cannot be activated before veneer plastering is begun, the plastering may proceed in accordance with an approved plan to maintain the environmental requirements specified below. Apply plaster prior to the installation of acoustic ceiling.

1.5.1 Environmental Requirements

Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of veneer plaster, while the plastering is being done, and for at least one week after the plaster is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during plaster application, set, and until plaster is dry. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following plastering and until plaster is dry.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the specifications, standards, and requirements specified herein. Provide asbestos-free materials.

2.2 GYPSUM BASE COAT PLASTER

2.2.1 Gypsum Ready-Mixed Plaster Base Coat

ASTM C28/C28M.

2.3 GYPSUM FINISH COAT PLASTER

2.3.1 Gypsum Gauging Plaster Finish Coat

ASTM C28/C28M.

2.4 HYDRATED LIME

ASTM C206, Type S.

2.5 AGGREGATES

2.5.1 Sand for Gypsum Base Coats

ASTM C35.

2.5.2 Sand for Gypsum Sand Float Finish

ASTM C842.

2.5.3 Lightweight Aggregates, Perlite or Vermiculite for Gypsum Base Coat

ASTM C35.

2.5.4 Silica Sand or Perlite Fines

For use in lime-putty gypsum-gauged finish, aggregated white coat, must have the following gradation: 10 percent maximum retained on a No. 30 sieve, 4 percent minimum and 70 percent maximum retained on a No. 100 sieve, and 70 percent minimum and 100 percent maximum retained on No. 200 sieve.

2.6 WATER

Use only potable water, free of mineral and organic substances that affect the hardening and durability of the plaster or stucco.

2.7 PROPORTIONING

Unless specified otherwise, materials are specified on a volume basis and must be measured in approved containers, to ensure that the specified proportions will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels (shovel count) is not be permitted. Prepare ready-mix gypsum plaster for use by the addition of water only.

2.7.1 Gypsum Base Coat Plaster

Use of sand or lightweight aggregate is optional in gypsum plaster basecoats.

2.7.1.1 Sand and Gypsum Plaster Base Coat

Mix scratch coat in the proportion of 100 lb of gypsum neat plaster to not more than 2 cu ft of damp loose sand; mix brown coat in the proportion of 100 lb of gypsum neat plaster to not more than 3 cu ft of damp loose sand; or scratch and brown coats may both be mixed in the proportion of 100 lb of gypsum neat plaster to not more than 2-1/2 cubic feet of damp loose sand.

2.7.2 Gypsum Plaster Finish Coat

2.7.2.1 Lime-Putty

Prepare lime-putty in accordance with the printed directions of the manufacturer. Use putty following preparation or following a soaking period as recommended by the manufacturer.

2.7.2.2 Aggregated Finish Coat

Finish coat must consist of the lime-putty, gypsum-gauged finish specified herein with the addition of fine pulverized silica sand or perlite fines in the following proportions:

a. 1/2 cu ft per 100 lb bag of gypsum gauging plaster used in finish, or

b. 1/8 cu ft per 50 lb bag of hydrated lime, or

c. one gal per cu ft of lime-putty.

2.8 MIXING

2.8.1 Job-Mixed Materials

Mix materials in mechanical mixers except finish coats containing lime may be hand mixed. Mechanical mixers must be an approved type that accurately and uniformly controls the quantity of water. When mixing by hand, mix dry plaster aggregate to a uniform color in the mixing box, add water, and hoe the plaster immediately into the water and mix thoroughly to a proper consistency.

2.8.1.1 Water

Water used for rinsing and cleaning containers and tools must not be used in mixing the materials.

2.8.1.2 Sand

Sand proportions must be damp and in loose condition. A volume of damp loose sand must contain a minimum of 80 lb of dry sand in one cu ft.

2.8.1.3 Mixing (Do's)

Mix the material while the mixer is in continuous operation in the following sequence:

a. Add maximum close to 90 percent of estimated quantity of water.

b. Add approximately one-half of the sand. If vermiculite or perlite is used, add all the aggregate.

c. Add cement and approved admixtures.

d. Add remainder of sand.

e. Mix with remainder of water as required. Mix until the mixture is uniform in color and consistency.

2.8.1.4 Mixing (Don'ts)

Avoid excessive mixing and agitation. Discard gypsum plaster which has begun to set before it is used; do not permit retempering. Do not use frozen, caked, or lumped materials. Empty mixers and mixing boxes after each batch is mixed, and keep free of old plaster.

2.8.2 Ready-Mixed Packaged Materials

Mix ready-mixed packaged gypsum plaster in accordance with manufacturer's printed instructions.

2.9 BONDING AGENT

ASTM C631, interior application.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces before application of gypsum plaster of projections, dust, loose particles, grease, bond breakers, and foreign matter. Do not apply plaster directly to surfaces (1) of masonry or concrete that have been coated with bituminous compound or other waterproofing agents, or (2) that have been painted or previously plastered. Before plaster work is started, wet masonry and concrete surfaces thoroughly with a fine fog spray of clean water to produce a uniformly moist condition. Check metal grounds, corner beads, screeds, and other accessories carefully for alignment before starting work. Do not apply gypsum plaster to surfaces containing frost.

3.2 WORKMANSHIP

3.2.1 Slump Tests

Apply Plaster by hand or machine. When a plastering machine is used, control the fluidity of gypsum plaster to have a slump of not more than 3 inch when tested using a 2 by 4 by 6 inch high slump cone. Subsequent to determining water content to meet the specified slump, do not add additional water to the mix. Conduct the slump test according to the following procedure:

a. Place cone on level, dry, non-absorptive base plate.

b. While holding cone firmly against base plate, fill cone with plaster taken directly from the hose or nozzle of the plastering machine, tamping with metal rod during filling to release air bubbles.

c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

d. Place cone in a vertical position adjacent to freed plaster sample, using care not to shake or move base plate.

e. Lay a straightedge across top of cone, being careful not to shake or move cone. Measure slump in inch from the bottom edge of the straightedge to the top of the slumped plaster sample.

3.2.2 Application

Apply gypsum plaster in three coats, except as follows:

Gypsum plaster applied to masonry using the two-coat double-up method.

Apply base coats with sufficient pressure and ensure plaster is sufficiently plastic to provide a strong bond to bases. Plaster must not be continuous across expansion and control joints occurring in walls, partitions, and ceilings. Finish work level, plumb, square, and true, within a tolerance of 1/8 inch in 8 ft, without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Form plaster work carefully around angles and contours, and well-up to screeds. Take special care to prevent sagging and consequent dropping of applications. There must be no visible junction marks in finish coat where one day's work adjoins another.

3.2.3 Control And Expansion Joints

Install control joints at locations indicated before applying gypsum plaster. Vertical joints must be continuous and butt horizontal joints against the vertical joints. Check expansion, control joints and accessories to ensure unrestrained movement, metal lath not continuous behind the joints, and area between joints do not exceed 150 sq ft.

3.2.4 Curing

3.2.4.1 Gypsum Plaster

Before the plaster has set, provide environmental controls to prevent the plaster from drying too fast. After the plaster has set, provide for rapid drying to develop high strength.

3.3 GYPSUM PLASTER WORK

ASTM C842.

3.3.1 Gypsum Plaster Thickness Requirements

Plaster thicknesses are from face of metal lath plaster base (scratch coat) or solid base surfaces.

a. Vertical Surfaces

Base Types	Base Coat	Finish Coat	Total Thickness
Masonry	3/8 inch	1/8 inch	1/2 inch

3.3.2 Gypsum Plaster Basecoat Work

3.3.2.1 Gypsum Two-Coat System

Apply the first coat to cover the base with sufficient material and pressure to form a good bond on the wall or ceiling base. Before the first coat has set and without scratching or cracking the surface, apply a second coat (double back) of the same material proportion as the base coat to the screeds. Straighten to a true surface without application of water, and cross rake or scratch to receive the finish coat.

3.3.3 Gypsum Plaster Finish Coats

Moderately moisten or fog spray base coat of plaster that has become dry before finish coat is applied. Accelerate plaster, if necessary, to provide a setting time of not more than 4 hours from the time the plaster is mixed.

3.3.3.1 Lime-Putty and Gypsum-Gauged Finish Coats

Apply lime-putty gypsum-gauged finish white coat or aggregated white coat over the base coat, scratch in thoroughly, lay on well, double back, and fill out to a true, even surface. Allow the finish to dry a few minutes, then trowel well with water. Apply maximum pressure in order to compact the finish coat and provide a smooth finish free from blemishes and irregularities. Apply trowel finish coats of gypsum-gauged lime-putty over properly prepared base coats as thin as possible and 1/16 to 1/8 inch thick for conventional plaster system, except as necessary in spots to level out hollows in base coat.

3.4 PATCHING AND POINTING

Cut out and patch loose, cracked, damaged, or defective gypsum plaster. Patch must match existing work in texture, color and finish flush with previously applied gypsum plaster surfaces. Point work abutting or adjoining finish work in a neat manner. Remove droppings or spatterings from surfaces. Leave clean and in a condition to receive paint or other finish. Remove protective covering from floors and other surfaces, and rubbish and debris from the interior of the building.

-- End of Section --

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SECTION 09 29 00

GYPSUM BOARD
08/16, CHG 4: 02/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C475/C475M	(2017) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C840	(2020) Standard Specification for Application and Finishing of Gypsum Board
ASTM C954	(2018) Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C1002	(2020) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C1396/C1396M	(2017) Standard Specification for Gypsum Board

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

GYPSUM ASSOCIATION (GA)

GA 214	(2010) Recommended Levels of Gypsum Board Finish

GA 216	(2010) Application and Finishing of Gypsum Panel Products

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
UL Fire Resistance	(2014) Fire Resistance Directory

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

Accessories

Submit for each type of gypsum board.

Gypsum Board

SD-06 Test Reports

ASTM E90 Factory Test Report

SD-07 Certificates

Asbestos Free Materials

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

SD-08 Manufacturer's Instructions

Safety Data Sheets

SD-10 Operation and Maintenance Data

Manufacturer Maintenance Instructions

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.3.1.1 Ceiling and Wall Systems

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.4.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Do not store gypsum wallboard with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

1.4.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.5 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 3 years of documented successful experience.

1.6 SCHEDULING

The gypsum wallboard must be taped, finished and primed before the installation of the highly-emitting materials.

Commence application only after the area scheduled for gypsum board work

is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and acoustic ceiling.

1.7 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

1.8 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per UL Fire Resistance or FM APP GUIDE.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only. Submit Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.

2.1.1 Gypsum Board

ASTM C1396/C1396M. Gypsum board must contain a minimum of 10 percent post-consumer recycled content, or a minimum of 40 percent post-industrial recycled content. Paper facings must contain a minimum of 100 percent recycled paper content. Gypsum cores must contain a minimum of 95 percent post-industrial recycled gypsum content. Provide gypsum wall board and panels meeting the emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type).

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Joint Treatment Materials

ASTM C475/C475M. Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.2.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.2.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.2.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.2.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.2.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.3 Fasteners

2.1.3.1 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.4 Adhesives

Not permitted.

2.1.4.1 Adhesive for Fastening Gypsum Board to Metal Framing

Not permitted.

2.1.4.2 Adhesive for Laminating

Not permitted.

2.1.5 Accessories

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

2.1.6 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

3.2.2 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.3 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214. Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.3.1 Uniform Surface

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

3.4 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.4.1 Sealing for Glass Mat or Reinforced Gypsum Board Sheathing

Apply silicone sealant in a 3/8 inch bead to all joints and trowel flat. Apply enough of the same sealant to all fasteners penetrating through the glass mat gypsum board surface to completely cover the penetration when troweled flat. Do not place construction and materials behind sheathing until a visual inspection of sealed joints during daylight hours has been completed by Contracting Officer.

3.5 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated. Joints of fire-rated gypsum board enclosures must be closed and sealed in accordance with UL test requirements. Seal penetrations through rated partitions tight in accordance with tested systems.

3.6 SOUND RATED ASSEMBLIES

When sound rated assemblies are required, provide materials and application methods, including panels, insulation, types and spacing of fasteners, wall framing in accordance with the contract document and the

description of the assembly in the ASTM E90 Factory Test Report. Seal partitions continuously with acoustical foam or sealant (both sides) and finished to match wall wherever it abuts another element such as the floor, ceiling, wall, column, mullion, or another system or assembly.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A489	(2018; E 2018) Standard Specification for Carbon Steel Eyebolts
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635/C635M	(2017) Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2017) Standard Specification for Latex Sealants
ASTM E795	(2016) Standard Practices for Mounting Test Specimens During Sound Absorption Tests
ASTM E1111/E1111M	(2014) Standard Test Method for Measuring

	the Interzone Attenuation of Open Office Components
ASTM E1264	(2019) Acoustical Ceiling Products
ASTM E1477	(1998a; R 2017; E 2018) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)	
CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
GREEN SEAL (GS)	
GS-36	(2013) Adhesives for Commercial Use
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	SCS Global Services (SCS) Indoor Advantage
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)	
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
UNDERWRITERS LABORATORIES (UL)	
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

SD-03 Product Data

Recycled Content for Type III Ceiling Tiles; S

Acoustical Performance; G

SD-04 Samples

Acoustical Ceiling Tiles

SD-07 Certificates

Indoor Air Quality for Type III Ceiling Tiles; S

Indoor Air Quality for Adhesives

Indoor Air Quality for Sealants

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Ceiling Tiles

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

1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship including but not limited to, sagging and warping of panels and rusting and of grid systems, for a period of ten years from date of final acceptance of the work.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 1,000 tiles installed.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. Provide the unit size, texture, finish, and color as specified. Coordinate the entire ceiling system with other details, like the location of access panels and ceiling penetrations, for instance, shown on the drawings. The Contractor is responsible for the final assembly and performance of the specified work. Provide the location and extent of acoustical treatment as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

2.1.1 Acoustical Performance

2.1.1.1 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423. Determine Articulation Class (AC) in accordance with ASTM E1111/E1111M.

2.1.2 Light Reflectance

Determine light reflectance factor in accordance with ASTM E1477 test method.

2.2 ACOUSTICAL UNITS

Submit samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E1264, Class A, and the following requirements:

2.2.1 Units for Exposed-Grid System ACT-1

2.2.1.1 Type

III (non-asbestos mineral fiber with painted finish). Provide Type III Acoustical Ceiling Tiles containing a minimum of 30 percent recycled content. Provide data identifying percentage of recycled content for Type III ceiling tiles. Provide certification of indoor air quality for Type III Ceiling Tiles.

2.2.1.2 Flame Spread

Class A, 25 or less

2.2.1.3 Pattern

C E

2.2.1.4 Minimum NRC

0.70 when tested on mounting Type E-400 of ASTM E795.

2.2.1.5 Minimum Light Reflectance Coefficient

0.82

2.2.1.6 Nominal Size

24 by 48 inch

2.2.1.7 Edge Detail

Square

2.2.1.8 Finish

Factory-applied standard finish. See paragraph COLORS AND STANDARDS.

2.2.1.9 Minimum CAC

40

2.3 SUSPENSION SYSTEM

Provide standard width flange suspension system conforming to ASTM C635/C635M for intermediate-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide mitered corners. Provide a suspension system with a maximum deflection of 1/360 of the span length capable of supporting the finished ceiling, light fixtures, air diffusers, and accessories, as shown.

Provide Suspension System containing a minimum of 15 percent recycled content. Provide data identifying percentage of recycled content for suspension systems.

2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.4.1 Wires

Conform wires to ASTM A641/A641M, Class 1, 0.08 inch (12 gauge) in diameter.

2.4.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.4.3 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Provide minimum 1/4 inch, zinc coated eyebolts.

2.4.4 Masonry Anchorage Devices

Comply with ASTM C636/C636M for anchorage devices for eyebolts, machine screws, or wood screws.

2.5 ADHESIVE

Use adhesive as recommended by tile manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. For products located on the interior of the building (inside of the weatherproofing system), provide certification or validation of indoor air quality for adhesives.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as specified in Section 09 06 00 SCHEDULES FOR FINISHES.

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining. Provide sealants used on the interior of the building (defined as inside of the weatherproofing system) in accordance with requirements of Section 07 92 00 JOINT SEALANTS that meet either emissions requirements of CDPH SECTION 01350 (limit the requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for Sealants.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings

in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Acoustical Sealant

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

-- End of Section --

SECTION 09 67 23.13

STANDARD RESINOUS FLOORING
11/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A990/A990M	(2021) Standard Specification for Castings, Iron-Nickel-Chromium and Nickel Alloys, Specially Controlled for Pressure-Retaining Parts for Corrosive Service
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D445	(2019a) Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D1475	(2013) Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D1544	(2004; R 2010) Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
ASTM D1652	(2011; E 2012) Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness

ASTM D2471	(1999) Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
ASTM D4259	(2018) Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application
ASTM F1869	(2016a) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Pre-Installation Meetings

Pre-installation Conference: Conduct conference at Project site.

1.2.2 Product Data

Within 30 days of contract award, submit manufacturer's catalog data for the following items:

a. Epoxy-Resin Binder/Matrix

b. Cured Epoxy Binder

c. Aggregate

d. Surface Sealing Coat

1.2.3 Design Mix Data

Within 30 days of contract award, submit design mix data for the following items, including a complete list of ingredients and admixtures:

a. Epoxy-Resin Binder/Matrix

b. Cured Epoxy Binder

c. Surface Sealing Coat

Ensure applicable test reports verify the mix has been successfully tested and meets design requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

Fabrication Drawings; G

SD-03 Product Data

Manufacturer's Catalog Data; G

SD-04 Samples

Hardboard Mounted Epoxy Flooring; G

Floor Topping; G

Mockups; G

SD-05 Design Data

Design Mix Data; G

SD-07 Certificates

Listing of Product Installations

Referenced Standards Certificates

SD-11 Closeout Submittals

Warranty; G

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction. Deliver materials in original packages, containers, or bundles bearing brand name and name of material.

Maintain materials used in the installation of floor topping at a temperature between 65 and 85 degrees F.

1.5 QUALITY CONTROL

Prior to commencement of work, submit referenced standards certificates for the following, showing conformance with the referenced standards contained in this section:

a. Epoxy-Resin Binder/Matrix

b. Cured Epoxy Binder

c. Aggregate

d. Surface Sealing Coat

1.5.1 Mockups

Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Apply full-thickness mockups on 96 inch square floor area

selected by Contracting Officer. Simulate finished lighting conditions for the review of mockups.

1.5.2 Qualifications

Submit a listing of product installations for heavy duty epoxy flooring including identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Identify purchaser, address of installation, service organization, and date of installation.

Ensure floor system applicators are experienced in the application of troweled walnut-shell aggregate thin-set floor topping.

1.5.3 Sampling

Submit hardboard mounted epoxy flooring samples not less than 12 inch square for each required color.

Provide panels showing nominal thickness of finished toppings, color, and texture of finished surfaces. Finished floor toppings and the approved samples are to match in color and texture.

1.6 WARRANTY

Submit a 2 year written warranty for all materials and installation work.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit installation drawings for heavy duty epoxy flooring systems clearly designating the areas of application and the installation plan. Include in the installation plan, methods to control sand and dust if sand blasting is required.

Submit fabrication drawings for heavy duty epoxy flooring Systems consisting of fabrication and assembly details to be performed in the factory.

2.2 MATERIALS

2.2.1 Mixes

2.2.1.1 Epoxy-Resin Binder/Matrix

Provide a clear two-component compatible system epoxy resin binder consisting of: (1) a liquid blend of a biphenyl-based epoxy resin and an aliphatic polyglyceride ether, and (2) a liquid blend of two modified amine curing agents, which individually cures the epoxy resin at room temperature to a glossy smooth film. Ensure the two components and the cured epoxy binder have the following physical properties:

PROPERTY	TEST METHOD	REQUIREMENT
	COMPONENT A (EPOXY RESIN)	
Viscosity (kinematic), at 77 degrees F, centipoises	ASTM D445	3000 to 5000
Weight per epoxide, grams	ASTM D1652	205 to 225
Color (Gardner Color Scale), maximum	ASTM D1544	5
Weight per gallon, pounds	ASTM D1475	9.46 - 9.56
	COMPONENT B (CURING AGENT)	
Viscosity (kinematic), at 77 degrees F, centistokes	ASTM D445	75 to 125
Weight per gallon, pounds	ASTM D1475	7.50 to 7.60
Color (Gardner Color Scale), maximum	ASTM D1544	8

2.2.1.2 Cured Epoxy Binder

Provide a cured epoxy binder with the following properties.

PROPERTY	TEST METHOD	REQUIREMENT
Tensile strength, psi* at test temperature: 77 degrees F	ASTM D638	4500 to 6500
Tensile elongation, percent* at test temperature: 77 degrees F	ASTM D638	20 to 40
Water absorption, percent 24 hours at 77 degrees F, maximum	ASTM D570	0.40
Hardness, Shore D	ASTM D2240	74 to 82
Linear shrinkage, inch/inch maximum	ASTM C881/C881M	0.006
Shrinkage, glass bow, inch divergence, maximum	ASTM A990/A990M	0.016

PROPERTY	TEST METHOD	REQUIREMENT
Coefficient of linear thermal expansion, inch/inch/degree C, maximum	ASTM D696 0 degrees C to 40 degrees C	200 X 10-6
Gel time/peak exotherm at 77 degrees F, 100 gm mass in 4 ounce metal container	ASTM D2471	20 to 40 minutes at 300 degrees F, maximum
*1/8 inch thick castings		
**1/8 by 1 by 3 inch castings, aged in forced draft oven		

2.2.1.3 Aggregate

Provide aggregate recommended by the resinous flooring manufacturer and approved by the Contracting Officer. Deliver aggregate to the site in three separate package gradations for blending. Gradations are:

	PERCENT	
SIEVE SIZE	MAXIMUM	MINIMUM
GRADUATION NO. 1		
Retained on No. 6	0.0	-
Passing No. 6, retained on No. 8	5.0	0.0
Passing No. 8, retained on No. 12	100.0	74.0
Passing No. 20	1.0	-
GRADATION NO. 2		
Retained on No. 16	0.0	-
Passing No. 16, retained on No. 18	5.0	0.0
Passing No. 18, retained on No. 40	100.0	85.0
Passing No. 40, retained on No. 60	9.0	0.0
Passing No. 60	1.0	-
GRADATION NO. 3		
Retained on No. 20	0.0	-

	PERCENT	
SIEVE SIZE	MAXIMUM	MINIMUM
Passing No. 20, retained on No. 35	5.0	0.0
Passing No. 35, retained on No. 60	100.0	80.0
Passing No. 60, retained on No. 100	13.0	0.0
Passing No. 100	2.0	-

2.2.1.4 Surface Sealing Coat

Provide nonambering aliphatic or aromatic moisture-curing polyurethane surface sealer into which has been incorporated a flatting agent. Add flatting agent not more than 24 hours prior to actual application of the coating. Ensure cured coating with flatting agent yields 60-degree specular gloss of 10 to 20 when tested in accordance with ASTM D523.

Provide silicone sand additive to achieve Static coefficient-of-friction (COF) value of 0.4 minimum.

PART 3 EXECUTION

3.1 PREPARATION

Prior to applying resinous flooring material, inspect substrate and immediately report any unsatisfactory conditions that exist and repair.

Verify that the concrete substrates are dry and the moisture-vapor emissions are within acceptable levels according to the manufacturer's written instructions.

Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. 4.5 lb of water/1000 sq ft. of slab area in 24 hours.

Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

Alkalinity and Adhesion Testing: Verify that concrete substrates have a pH within an acceptable range. Perform tests recommended by the manufacturer. Proceed with the application only after the substrates pass testing.

3.1.1 Safety Precautions

Prior to application in confined spaces of toppings and coatings containing flammable or toxic properties, institute safety precautions recommended by the manufacturer of the product.

Erect "NO SMOKING" signs, and prohibit smoking or use of spark- or

flame-producing devices within 50 feet of any mixing or placing operation involving flammable materials.

Provide the personnel required to handle, mix, or apply toppings containing toxic or flammable properties with such items of personal protective equipment and apparel for eye, skin, and respiratory protection as are recommended by the manufacturer of the product. Ensure all personnel are trained in the appropriate use and wearing of personal protection equipment.

3.1.2 Protection of Adjacent Surfaces

In addition to the protection of adjacent surfaces during installation, provide areas used to store and mix materials with a protective covering under the materials. After application of the sealer coats, protect finished flooring during the remainder of the construction period. In areas of expected minimum or moderate traffic, cover floors with 70 pound kraft paper or a 30-30-30 waterproof kraft paper, with strips taped together and edges secured to prevent roll-up. Place vegetable fiberboard, plywood, or other suitable material that does not mar the flooring over the paper to protect areas used as passages by workmen and areas subject to floor damage because of subsequent building operations. Upon completion of construction, remove the protection, clean flooring and, where necessary, repair, reseal, or both, at no additional cost to the Government.

3.1.3 Concrete Subfloor

3.1.3.1 Existing Concrete Floors

Clean existing concrete floors, with hard troweled or contaminated areas in conformance with ASTM D4259. Ensure the concrete is free of all paint, sealers, curing agents, oil, grease, moisture, dirt or any other contaminants. Remove any loose or corroded segments of existing concrete. Patch with a grouting compound as recommended by the resinous flooring manufacturer. Fill all cracks with an elastomeric jointing compound compatible with the resinous flooring system used.

3.1.4 Mixing Of Materials

Select the job mix proportions on the trial batch proportions used to prepare the floor topping samples as submitted and approved.

Use mechanical equipment for mixing of materials in accordance with the manufacturer's instructions.

Use rotating paddle-type masonry mortar mixers for preblending the three sizes and color pigment, if any, of the walnut shell aggregate and addition of the mixed epoxy resin binder. Ensure mixing times are as recommended by the materials supplier(s), provided mixing times result in homogeneous mixtures. Limit quantity of material mixed at one time to that which can be applied and finished within the working life of the mixtures. Verify that the temperature of materials at the time of mixing are between 65 and 85 degrees F.

3.2 APPLICATION

3.2.1 Areas of Application

Anchor plates set with the top surface at or above the finished epoxy floor level do not require coverage with this flooring material. Extend flooring under equipment, except when the equipment base is indicated to be flush against the structural floor. Cover and/or mask surfaces not to receive the epoxy floor topping, such as equipment or cabinets installed prior to surface-preparation efforts and adjacent to the flooring installation.

3.2.2 Application of Prime Coat and Troweling

Combine the epoxy binder components A and B in the proportions specified by the manufacturer to form a clear compatible system immediately on mixing. Cure combined components to a clear film possessing a glossy, non-greasy surface at relative humidities less than 80 percent, having the following properties after curing 24 hours at 77 degrees F, followed by 24 hours at 125 degrees F:

Ensure that the prepared subfloor surface is dry and at a temperature of not less than 60 degrees F when application of the floor topping is initiated. Immediately before application of the prime/scratch coat on the prepared surface, remove dust or other loose particles by blowing with compressed air or vacuum cleaned. Use only an air compressor equipped with an efficient oil-water trap to prevent oil contamination or wetting of surface.

Apply a thin roller coat of the epoxy binder specified to the prepared subfloor as a prime coat. As an aid to placing, compacting, and finishing the floor topping, form a scratch coat by sprinkling a minimum quantity of the walnut shell aggregate on the prime coat surface immediately following the prime coat application. Prior to application of the prime/scratch coat, fill cracks in the concrete per manufacturer's instructions, and make provisions to keep control or expansion joints open.

Place the floor topping prior to final gelling of the prime/scratch coat. Immediately after the materials are mixed as specified, dump the mixture in the placement area and spread to prolong troweling life. Screed or rough trowel placed materials to the specified thickness and then compact by the use of a smooth roller prior to finish troweling to a nominal thickness of 3/16 inch plus or minus 1/16 inch. Ensure all finished surfaces are free of ridges, hollows (bird-baths), trowel marks, and smoothness varies no more than 1/8 inch when tested with an 8 foot straightedge. Make provisions to maintain the work areas in a relatively dust-free environment during curing of the topping.

3.2.3 Sealer Coat

After the floor topping has set firmly (approximately 6 to 16 hours depending on subfloor temperature) in a relatively dust-free environment, apply two thin coats of the sealer coat, by means of brush, roller, squeegee, or notched trowel to provide a pore-free, easy-to-clean surface. At the time of sealer application, ensure that the surface is dust-free. Depending on relative humidity, allow the applied sealer to cure to a tack-free condition in 2 to 4 hours. Do not apply second coat until after the initial coat has cured to a tack-free, hard film. Maintain topping areas in a relatively dust-free environment during curing

of the sealer coats.

3.3 FIELD QUALITY CONTROL

3.3.1 Repairing

Remove and replace damaged or unacceptable portions of completed work with new work to match adjacent surfaces at no additional cost to the Government.

3.4 ADJUSTING AND CLEANING

Clean surfaces of the new work, and adjacent surfaces soiled as a result of the work. Remove all equipment, surplus materials, and rubbish associated with the work from the site.

-- End of Section --

SECTION 09 68 00

CARPETING
11/17, CHG 2: 08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(2004; E 2008; E 2010) Colorfastness to Light
AATCC 107	(2013) Colorfastness to Water
AATCC 165	(2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method

ASTM INTERNATIONAL (ASTM)

ASTM D1335	(2017; E 2018) Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
ASTM D2859	(2016) Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
ASTM D3278	(1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D5793	(2018) Standard Test Method for Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings
ASTM D5848	(2020) Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
ASTM D6859	(2011) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings
ASTM D7330	(2015) Standard Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales
ASTM E648	(2019a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for

	the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
CARPET AND RUG INSTITUTE (CRI)	
CRI 104	(2015) Carpet Installation Standard for Commercial Carpet
CRI 105	(2015) Carpet Installation Standard for Residential Carpet
CRI GLP QM	(2017) Green Label Plus Quality Manual
CRI Test Method 103	(2015) Standard Test Method for the Evaluation of Texture Appearance Retention of Carpet Standards Program
GREEN SEAL (GS)	
GS-36	(2013) Adhesives for Commercial Use
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)	
ISO 2551	(2020) Textile Floor Coverings and Textile Floor Coverings in Tile Form-Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions and Distortion Out of Plane
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	SCS Global Services (SCS) Indoor Advantage
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)	
SCAQMD Rule 1113	(2016) Architectural Coatings
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
16 CFR 1630	Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)
UNDERWRITERS LABORATORIES (UL)	
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Carpet

Recycled Content for Carpeting

Moldings

Indoor Air Quality for Non-Aerosol Adhesives

Indoor Air Quality for Concrete Primer

SD-04 Samples

Carpet

Moldings

SD-07 Certificates

Indoor Air Quality for Carpet

SD-08 Manufacturer's Instructions

Surface Preparation

SD-10 Operation and Maintenance Data

Cleaning and Protection

Maintenance Service

SD-11 Closeout Submittals

Warranty

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Floor Covering Materials

Provide carpet and cushion products certified to meet indoor air quality requirements by UL 2818 (GreenGuard) Gold, SCS Global Services Indoor Advantage Gold, CRI GLP QM or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size,

dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Do not store carpet or carpet tiles with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including paints and adhesives. Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.5 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

PART 2 PRODUCTS

2.1 CARPET

Furnish first quality carpet that is free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Submit manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's Product Data for 1) Carpet, 2) Moldings, and 3) Carpet Cushion. Also, submit Samples of the following:

a. Carpet: Six "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified

2.1.1 Recycled Content

Carpeting must contain a minimum of 38 percent recycled content. Provide data identifying percentage of recycled content for carpeting.

2.1.2 Indoor Air Quality Requirements

Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for carpet.

2.1.3 Physical Characteristics for Modular Tile Carpet (CPT-1)

2.1.3.1 Carpet Construction

Tufted

2.1.3.2 Type

Modular tile24 by 24 inch square with 0.15 percent growth/shrink rate in accordance with ISO 2551.

2.1.3.3 Pile Type

Multilevel loop

2.1.3.4 Pile Fiber

Commercial 100 percent branded (federally registered trademark) nylon continuous filament.

2.1.3.5 Gauge or Pitch

Minimum 1/12 inch in accordance with ASTM D5793

2.1.3.6 Stitches or Rows/Wires

Minimum 8.5 per square inch

2.1.3.7 Surface Pile Weight

Minimum 16 ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D5848.

2.1.3.8 Pile Thickness

Minimum 0.094 inch in accordance with ASTM D6859

2.1.3.9 Pile Density

Minimum 6128 oz/yd3

2.1.3.10 Dye Method

Solution dyed

2.1.3.11 Backing Materials

Provide primary backing materials like those customarily used and accepted by the trade for each type of carpet. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet.

2.2 PERFORMANCE REQUIREMENTS

2.2.1 Texture Appearance Retention Rating (TARR)

Provide carpet with a greater than or equal to 3.0 (Heavy) TARR traffic level classification in accordance with ASTM D7330 or CRI Test Method 103.

2.2.2 Flammability and Critical Radiant Flux Requirements

Comply with 16 CFR 1630 or ASTM D2859. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E648.

2.2.3 Tuft Bind

Comply with ASTM D1335 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 8 pound average force for modular carpet tile.

2.2.4 Colorfastness to Crocking

Comply dry and wet crocking with AATCC 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

2.2.5 Colorfastness to Light

Comply colorfastness to light with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

2.2.6 Colorfastness to Water

Comply colorfastness to water with AATCC 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

2.2.7 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

2.3 ADHESIVES AND CONCRETE PRIMER

Comply with applicable regulations regarding toxic and hazardous materials. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D3278. Non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide validation of indoor air quality for aerosol adhesives. Provide validation of indoor air quality for non-aerosol adhesives. Concrete primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1113. Provide validation of indoor air quality for concrete primer.

2.4 MOLDINGS

Provide carpet moldings where floor covering material changes or carpet edge does not abut a vertical surface. Provide rubber molding designed for the type of carpet being installed. Provide floor flange of a minimum 1 1/2 inches wide. Provide color to match resilient base.

2.5 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed Installation instructions for the carpet, including Surface Preparation, seaming techniques, and recommended adhesives and tapes.

3.2 INSTALLATION

Isolate area of installation from rest of building. Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI 104/CRI 105. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets.Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet. Submit three copies of Installation Drawings for 1) Carpet, and 2) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

Do not install building construction materials that show visual evidence of biological growth.

3.2.1 Modular Tile Installation

Install modular tiles with releasable manufacturer approved adhesive tab system adhesive and snug joints. Use 1/4 turn installation method. Comply with manufacturer installation instructions for required drying time of releasable adhesive so it sets up properly. Provide accessibility to the subfloor where required. Carpet tile on stairs and sloped surfaces must be installed with a more permanent installation method in accordance with the manufacturer's instructions and with manufacturer recommended adhesives for this application.

3.3 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

3.3.1 Cleaning

As specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

3.3.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

3.4 REMNANTS

Manage waste as specified in the Waste Management Plan.

3.5 MAINTENANCE

3.5.1 Extra Materials

Provide extra material from same dye lot consisting of uncut carpet tiles for future maintenance. Provide a minimum of three percent of total square yards of each carpet type, pattern, and color. Furnish three percent extra of total adhesive tabs.

3.5.2 Maintenance Service

Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Service must reclaim materials for recycling and/or reuse. Service must not landfill or burn reclaimed materials. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation of manufacturer's maintenance agreement or take-back program for carpet. Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and reuse.

-- End of Section --

SECTION 09 84 00

ACOUSTICAL SOUND BARRIER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C518	(2021) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C840	(2020) Standard Specification for Application and Finishing of Gypsum Board
ASTM D3273	(2021) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E90	(2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM G21	(2021-e1) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2014) Fire Resistance Directory

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

Acoustical Sound Barrier; G

SD-08 Manufacturer's Instructions

Installation Instructions

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original unopened packaging to the job site and store in ventilated dry locations permitting easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Acclimate materials for a minimum of 24 hours at temperatures 60 degrees F or greater to reduce material stiffness when handling. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

1.4 PROJECT CONDITIONS

Install acoustical sound barrier after framing, insulation, and electrical work is complete. Ensure that all applicable inspections are completed prior to installation of the acoustical sound barrier.

a. Drywall must be installed within 2-4 weeks after the acoustical sound barrier has been installed to prevent excessive wear.

(1) For longer delays, washers must be installed for securely fastening the material.

PART 2 PRODUCTS

2.1 MATERIALS

Submit product data and manufacturer’s specifications including laboratory test summary for acoustical sound barrier, flexible Ethylene Vinyl Acetate (EVA) made from post-industrial recycled material.

2.1.1 Dimensions

a. Thickness: 1/8 inch

b. Weight: 1 pound/square feet

c. Standard Sizes: 4 feet x 25 feet rolls; 4 feet x 10 feet and 4 feet x 8 feet sheets.

d. Tolerances:

(1) Width: +/- 0.5 inch

(2) Length: +/- 1 percent

(3) Nominal Thickness: +/- 0.10 inch

2.1.2 Performance

a. Minimum STC = 25 (ASTM E90)

b. UL Fire Resistance:

(1) 300, 400, 500 Series

c. Flammability Rating:

(1) Class 1 (ASTM E84)

(2) 1-Hour fire resistance wall rating (ASTM E119)

(3) 0.3 Thermal Resistance coefficient (ASTM C518)

d. Environmental:

(1) Mold/Mildew resistant. No fungal/algae growth and no visible disfigurement (ASTM D3273 & ASTM G21).

(2) Impermeable air and moisture barrier.

(3) Non-PVC: No off-gassing.

PART 3 EXECUTION

3.1 PREPARATION

a. Wall and/or stud assembly to receive acoustical sound barrier must be structurally sound prior to installation.

b. Wall and/or stud assembly to receive acoustical sound barrier must be clean and free of debris.

(1) Protrusions greater than 1/16 inch must be scraped from the surface to avoid puncturing.

c. Refer to paragraph 1.4 above for additional project condition requirements.

3.2 INSTALLATION

3.2.1 Systems for Attachment of Lath

Submit installation instructions including but not limited to detailed installation procedure including job site condition requirements and surface preparation requirements.

3.2.2 Acoustical Sound Barrier

Starting in one corner of the room, install acoustical sound barrier flush with the top of the top plate, and hang it vertically.

a. Metal Studs:

(1) Attach acoustical sound barrier directly to the metal studs using drywall screws.

(2) Fasten every 12 inches horizontally along the top.

(a) Acoustical sound barrier installed on walls greater than 15 feet in height must be secured with washers along the top to

prevent the fasteners from tearing the material.

(b) Fasteners must be used on intermediate studs (in addition to exterior studs) every 12 feet vertically.

b. Straighten acoustical sound barrier from the top down so that it is flush against the studs.

c. Attach acoustical sound barrier to the center of each vertical stud using drywall screws.

d. Fasten every 36 inches vertically along the center of each stud.

3.3 PROCEDURE

a. Install acoustical sound barrier on all walls as indicated in the drawings.

b. Keep fasteners as flush as possible to prevent protrusion into the finished wallboard.

(1) Fasteners must not protrude more than 1/16 inch from acoustical sound barrier surface.

c. Do NOT overlap the seams of separate sheets.

(1) Tightly butt the side of the next sheet of acoustical sound barrier to the edge of the existing attached sheet.

d. For seams that do not fall on a stud, tape with manufacturer's recommended tape or equivalent.

(1) If seams fall on the stud with gaps greater than 1/8 inch, taping seam is also required.

(2) Ensure that there are no bubbles or wrinkles in the tape. Commercial tape alternatives include commercial duct tape.

(3) The tape is semi-permanent and will be permanently sealed in position when drywall is installed.

e. Cut acoustical sound barrier to fit around irregular objects and penetrations including outlets, switches, and junction boxes.

(1) Gaps must be less than 1/8 inch wide.

(2) Gaps greater than 1/8 inch wide must be sealed with acoustical or non-hardening caulk.

(3) Gaps greater than 1/4 inch may be filled with backer rod or fiber batting.

(4) Putty pads must be installed on the back of all electrical boxes.

f. Caulk the bottom of the floor plate at the floor line with acoustical sealant.

g. Install drywall per normal technique (ASTM C840).

(1) Acoustical sound barrier will be fastened permanently when the gypsum board is installed.

-- End of Section --

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SECTION 09 84 20

ACOUSTICAL WALL PANELS
08/16, CHG 1: 08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(2004; E 2008; E 2010) Colorfastness to Light

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM D5034	(2009; R 2017) Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G

SD-03 Product Data

Installation

Acoustical Wall Panels; G

Bio-Based Content for Fabric Panels

SD-04 Samples

Acoustical Wall Panels; G

SD-07 Certificates

Acoustical Wall Panels

SD-11 Closeout Submittals

Warranty

1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design

Provide fabric wrapped mineral / glass-fiber core acoustical wall panel materials in the manufacturer's standard sizes and finishes of the type, design and configuration indicated.

2.1.1.1 Bio-Based Recycled Content

Fabric Panels must contain bio-based yarn. Provide data identifying percentage of bio-based content for fabric panels.

2.2 FABRIC COVERED ACOUSTICAL WALL PANELS

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass or mineral fiber core system as described below manufactured to the dimensions and configurations shown on the approved detail drawings; submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges must be reinforced by either an aluminum frame or a formulated resin edge hardener. Acoustical wall panels installed in non-sprinklered areas must comply with the requirements of ICC IBC, Standard 42-2. Submit manufacturer's descriptive data and catalog cuts; fabric and vinyl swatches, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels must conform to the following:

2.2.1 Panel Width

Panel width must be as detailed on the drawings.

2.2.2 Panel Height

Panel height must be as detailed on the drawings.

2.2.3 Thickness

As indicated on the drawings.

2.2.4 Fabric Covering

Seamless plain woven 2-ply 100 percent branded bio-based content yarn, Xorel or equal minimum 16 ounces/linear yard. Tear strength a minimum 29 pounds. Tensile strength 150 pounds minimum in accordance with ASTM D5034. Stretch fabric covering free of wrinkles and then bond to the edges and back or bond directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) approximately 40 hours in accordance with AATCC 16.

2.2.5 Fire Rating for the Complete Composite System

Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E84.

2.2.6 Substrate

Fiber glass or mineral fiber

2.2.7 Noise Reduction Coefficient (NRC) Range

0.80-0.90 ASTM C423

2.2.8 Edge Detail

Square edge with fabric wrapped on all four sides.

2.2.9 Core Type

Acoustical/tackable core.

2.2.10 Mounting Acoustical Panels

Mount acoustical panels by manufacturer's standard concealed spline.

2.3 COLOR

In accordance with Section 09 06 00 SCHEDULES FOR FINISHES. Color listed is not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Must be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as plastering, painting, and concrete, are completely dry.

3.2 INSTALLATION

Panel installation must be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

3.3 CLEANING

Following installation, clean dirty or stained panel surfaces in accordance with manufacturer's instructions and leave free from defects. Remove and replace panels that are damaged, discolored, or improperly installed.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS
02/21

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.1.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.1.1.1 Interior Painting

Includes new surfaces, existing uncoated surfaces, and existing coated surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.1.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, anodized aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

f. Do not paint surfaces in the following areas as indicated on the drawings.

1.1.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new and existing surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

b. Do not paint the following, unless indicated otherwise:

(1) New zinc-coated, aluminum, and copper surfaces under insulation

(2) New aluminum jacket on piping

(3) New interior ferrous piping under insulation.

1.1.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100	(2017; Suppl 2020) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D235	(2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4444	(2013; R 2018) Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters

ASTM D6386	(2016a) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

Intelligence Bulletin 65	(2013) Occupational Exposure to Carbon Nanotubes and Nanofibers

MASTER PAINTERS INSTITUTE (MPI)

MPI 9	(2016) Alkyd, Exterior Gloss (MPI Gloss Level 6)
MPI 47	(2016) Alkyd, Interior, Semi-Gloss (MPI Gloss Level 5)
MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 72	(2016) Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)
MPI 76	(2016) Primer, Alkyd, Quick Dry, for Metal
MPI 101	(2016) Primer, Epoxy, Anti-Corrosive, for Metal
MPI 107	(2016) Primer, Rust-Inhibitive, Water Based
MPI 139	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 3)
MPI ASM	(2019) Architectural Painting Specification Manual
MPI GPS-1-14	(2014) Green Performance Standard GPS-1-14
MPI GPS-2-14	(2014) Green Performance Standard GPS-2-14
MPI MRM	(2015) Maintenance Repainting Manual

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC Glossary	(2011) SSPC Protective Coatings Glossary
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC QP 1	(2019) Standard Procedure for Evaluating the Qualifications of Industrial/Marine Painting Contractors (Field Application to Complex Industrial Steel Structures and Other Metal Components)
SSPC SP 1	(2015) Solvent Cleaning

SSPC SP 2	(2018) Hand Tool Cleaning
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC-SP WJ-2/NACE WJ-2	(2012) Very Thorough Cleaning, Waterjet Cleaning of Metals
SSPC-SP WJ-3/NACE WJ-3	(2012) Thorough Cleaning, Waterjet Cleaning of Metals

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(2018) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants

1.3 DEFINITIONS

1.3.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third-party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.3.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing must be accomplished by an MPI testing lab.

1.3.3 Coating

SSPC Glossary; (1) A liquid, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer; (2) Generic term for paint, lacquer, enamel.

1.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.3.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five levels are generically defined under the Assessment sections in the MPI MRM, MPI Maintenance Repainting Manual.

1.3.6 INT

MPI short term designation for an interior coating system.

1.3.7 Loose Paint

Paint or coating that can be removed with a dull putty knife.

1.3.8 mil / mils

The English measurement for 0.001 in or one one-thousandth of an inch.

1.3.9 MPI Gloss Levels

MPI system of defining gloss. Seven gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degree angle	Units at 80 degree angle
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and

Gloss (G6).

1.3.10 MPI System Number

The MPI coating system number in each MPI Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN).

1.3.11 Paint

SSPC Glossary; (1) Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate in a thin layer that is converted to an opaque solid film after application. Used for protection, decoration, identification, or to serve some other functional purposes; (2) Application of a coating material.

1.3.12 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.3.13 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

1.4 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs, including carpets, textiles, unprimed gypsum wallboard, and acoustical ceiling panels.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Samples of specified materials may be taken and tested for compliance with specification requirements.

SD-02 Shop Drawings

Piping Identification

SD-03 Product Data

Coating

Product Data Sheets

SD-04 Samples

Color

SD-07 Certificates

Qualification Testing laboratory for coatings

Indoor Air Quality for Paints and Primers

Indoor Air Quality for Consolidated Latex Paints

SD-08 Manufacturer's Instructions

Mixing

Manufacturer's Safety Data Sheets

SD-10 Operation and Maintenance Data

Coatings, Data Package 1; G

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

1.6.1.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.6.1.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.6.1.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.6.1.4 Asbestos Content

Provide asbestos-free materials.

1.6.1.5 Mercury Content

Provide materials free of mercury or mercury compounds.

1.6.1.6 Silica

Provide abrasive blast media containing no free crystalline silica.

1.6.1.7 Human Carcinogens

Provide materials that do not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6.1.8 Carbon Based Fibers / Tubes

Materials must not contain carbon based fibers such as carbon nanotubes or carbon nanofibers. Intelligence Bulletin 65 ranks toxicity of carbon

nanotubes on a par with asbestos.

1.6.2 Coating Contractor's Qualification

Submit the name, address, telephone number, and e-mail address of the Contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address and telephone number of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.6.3 SSPC QP 1 Certification

Contractors that perform surface preparation or coating application on steel substrates must be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the requirements of SSPC QP 1 prior to Contract award, and must remain certified while accomplishing any surface preparation or coating application. If a Contractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered. Notify the Contracting Officer of any change in Contractor certification status. Notify the Contracting Officer of all scheduled and unannounced on-site audits from SSPC and furnish a copy of all audit reports.

1.6.4 Approved Products List

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of Contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire Contract and each coating system is to be from a single manufacturer. Provide all coats on a particular substrate from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

1.6.5 Paints and Coatings Indoor Air Quality Certifications

Provide paint and coating products certified to meet indoor air quality requirements by MPI GPS-1-14, MPI GPS-2-14 or provide certification by other third-party programs. Provide current product certification documentation from certification body.

Provide certification of Indoor Air Quality for Paints and Primers. Provide certification of Indoor Air Quality for Consolidated Latex Paints. Submit required indoor air quality certifications in one submittal package.

1.6.6 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph SAMPLING PROCEDURE. Test each chosen product as specified in the paragraph TESTING PROCEDURE. Remove products from the job site which do not conform, and replace with new products that conform to the referenced specification. Test replacement products that failed initial testing as specified in the paragraph TESTING PROCEDURE at no cost to the Government.

1.6.6.1 Sampling Procedure

Select paint at random from the products that have been delivered to the job site for sample testing. The Contractor must provide one quart samples of the selected paint materials. Take samples in the presence of the Contracting Officer, and label, and identify each sample. Provide labels in accordance with the paragraph PACKAGING, LABELING, AND STORAGE.

1.6.6.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph QUALIFICATION TESTING laboratory for coatings. Include the backup data and summary of the test results within the qualification testing lab report. Provide a summary listing of all the reference specification requirements and the result of each test. Clearly indicate in the summary whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If MPI is chosen to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

1.7 PACKAGING, LABELING, AND STORAGE

Provide paints in sealed containers that legibly show the Contract specification number, designation name, formula or specification number,

batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Furnish pigmented paints in containers not larger than 5 gallons. Store paints and thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to absorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.8 SAFETY AND HEALTH

Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26.00 06 GOVERNMENTAL SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. Include in the Activity Hazard Analysis the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.8.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Safety Data Sheets (SDS) or local regulation.

b. 29 CFR 1910.1000.

c. ACGIH 0100, threshold limit values.

Submit manufacturer's Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

1.9 ENVIRONMENTAL REQUIREMENTS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Less than 5 degrees F above dew point;

b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Do not, under any circumstances, violate the manufacturer's application recommendations.

1.9.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit Product Data Sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems. Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, pot life, and curing and drying times between coats.

2.2 COLOR SELECTION OF FINISH COATS

Provide colors of finish coats as indicated or specified. Allow Contracting Officer to select colors not indicated or specified. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors are approximately the colors indicated and the product conforms to specified requirements.

Provide color, texture, and pattern of wall coating systems in accordance with Section 09 06 00 SCHEDULES FOR FINISHES and as indicated on the drawings. Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated. Submit color stencil codes. Tint each coat progressively darker to enable confirmation of the number of coats.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, reinstall removed items by workmen skilled in the trades. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so that dust and other contaminants will not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, with a suitable

corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. Refer to MPI ASM and MPI MRM for additional more specific substrate preparation requirements.

3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.

b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D235 or as specified in MPI MRM. Wipe the surfaces dry with a clean, dry, lint free cloth. Wipe immediately preceding the application of the first coat of any coating, unless specified otherwise.

c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.

d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer and specific surface preparation requirements as outlined in MPI MRM Exterior Surface Preparation and Interior Surface Preparation.

e. Thoroughly clean previously painted surfaces specified to be repainted or damaged during construction of all grease, dirt, dust or other foreign matter.

f. Remove blistering, cracking, flaking and peeling or otherwise deteriorated coatings.

g. Remove chalk so that when tested in accordance with ASTM D4214, the chalk resistance rating is no less than 8.

h. Roughen slick surfaces. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.

i. Feather and sand smooth edges of chipped paint.

j. Clean rusty metal surfaces in accordance with SSPC requirements. Use solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting.

k. Provide new, proposed coatings that are compatible with existing coatings.

3.2.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, SSPC SP 6/NACE No.3, or SSPC SP 10/NACE No. 2. Brush-off blast remaining surface in accordance with SSPC 7/NACE No.4. Protect shop-coated ferrous surfaces from corrosion by treating and touching up corroded areas immediately upon detection.

b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 10/NACE No. 2 / SSPC-SP WJ-2/NACE WJ-2.

3.3.2 Final Ferrous Surface Condition:

3.3.2.1 Tool Cleaned Surfaces

Comply with SSPC SP 2 and SSPC SP 3. Use as a visual reference, photographs in SSPC VIS 3 for the appearance of cleaned surfaces.

3.3.2.2 Abrasive Blast Cleaned Surfaces

Comply with SSPC 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. Use as a visual reference, photographs in SSPC VIS 1 for the appearance of cleaned surfaces.

3.3.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. Completely remove coating by brush-off abrasive blast if the galvanized metal has been passivated or stabilized. Do not "passivate" or "stabilize" new galvanized steel to be coated. If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D6386, Appendix X2, and remove by one of the methods described therein.

b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC-SP WJ-3/NACE WJ-3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3 to remove existing coating.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Gypsum Board

3.4.1.1 Surface Cleaning

Verify that plaster and stucco surfaces are free from loose matter and

that gypsum board is dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint is water-based.

3.4.1.2 Repair of Minor Defects

Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

3.4.1.3 Allowable Moisture Content

Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D4263. Verify that new plaster to be coated has a maximum moisture content of 8 percent, when measured in accordance with ASTM D4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 APPLICATION

3.5.1 Coating Application

a. Comply with applicable federal, state and local laws enacted to ensure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

b. At the time of application, paint must show no signs of deterioration. Maintain uniform suspension of pigments during application.

c. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Use rollers for applying paints and enamels of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

d. Only apply paints, except water-thinned types, to surfaces that are completely free of moisture as determined by sight or touch.

e. Thoroughly work coating materials into joints, crevices, and open spaces. Pay special attention to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

f. Apply each coat of paint so that dry film is of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Completely hide all blemishes.

g. Touch up damaged coatings before applying subsequent coats. Broom clean and clear dust from interior areas before and during the application of coating material.

h. Apply paint to new fire extinguishing sprinkler systems including

valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. Upon completion of painting, remove protective covering from sprinkler heads.

i. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.

j. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel (MPI 9) applied to a minimum dry film thickness of 1.0 mil or two component gloss polyurethane (MPI 72) in exterior applications.

k. Provide labeling on the surfaces of all feed and cross mains to show the pipe function such as "Sprinkler System", "Fire Department Connection", "Standpipe". For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 in in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75 in in height and visible from the floor.

l. All fire suppression system valves must be marked with permanent tags indicating normally open or normally closed.

m. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

n. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Cover each preceding coat or surface completely by ensuring visually perceptible difference in shades of successive coats.

o. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

p. Thermosetting Paints: Apply topcoats over thermosetting paints (epoxies and urethanes) within the overcoat window recommended by the manufacturer.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when

thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. Verify that the written permission includes quantities and types of thinners to use.

When thinning is allowed, thin paints immediately prior to application with not more than one pint of suitable thinner per gallon. The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

3.5.3 Two-Component Systems

Mix two-component systems in accordance with manufacturer's instructions. Follow recommendation by the manufacturer for any thinning of the first coat to ensure proper penetration and sealing for each type of substrate.

3.5.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table for Interior Applications	
MPI Division	Substrate Application
MPI Division 5	Interior Metal, Ferrous and Non-Ferrous Paint Table
MPI Division 9	Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness, where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat unspecified surfaces the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in MPI Division 5 for Interior.

a. Apply specified ferrous metal primer to steel surfaces on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat. Overcoat these items with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.7 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.8 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.9 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, contact local recyclers to reclaim the materials. Set aside extra paint for future color matches or reuse by the Government.

3.10 PAINT TABLES

All DFT's are minimum values. Acceptable products are listed in the MPI Green Approved Products List, available at http://www.specifygreen.com/APL/ProductIdxByMPInum.asp.

3.10.1 Interior Paint Tables

3.10.1.1 MPI Division 5: Interior Metal, Ferrous Paint Table

a. Interior Steel / Ferrous Surfaces

(1) Metal, Interior Hollow Metal Door Frames, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment.

Alkyd				
New, uncoated Existing	Primer	Intermediate	Topcoat	System DFT
MPI INT 5.1E-G5 (Semigloss)	MPI 76	MPI 47	MPI 47	5.25 mils

3.10.1.2 MPI Division 9: Interior Plaster, Gypsum Board Surfaces Paint Table

a. Interior New and Existing, previously painted Plaster and Wallboard not otherwise specified.

High Performance Architectural Latex - High Traffic Areas					
New	Existing, previously painted	Primer	Intermediate	Topcoat	System DFT
MPI INT 9.2B-G3 (Eggshell)	MPI RIN 9.2B-G3 (Eggshell)	MPI 50	MPI 139	MPI 139	4 mils
Topcoat: Coating to match adjacent surfaces.					

-- End of Section --

SECTION 10 14 00.20

INTERIOR SIGNAGE
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 800-82	(2015; Rev 2) Guide to Industrial Control Systems (ICS) Security

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8510.01	(2020; Change 1-2020) Risk Management Framework (RMF) for DoD Information Technology (IT)
DODI 8500.01	(2014) Cybersecurity
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Room Identification and Directional Signage System; G

SD-04 Samples

Interior Signage; G

Software

Room Identification and Directional Signage System

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions; G

Protection and Cleaning; G

1.3 EXTRA MATERIALS

Provide five extra frames and extra stock of the following: blank plates of each color and size for all sign types included in project, changeable message strips for sign type. Provide five paper inserts and one copy of the software for user produced signs and inserts after project completion and equipment necessary for removal of signage parts and pieces.

1.4 QUALITY ASSURANCE

1.4.1 Samples

Submit interior signage samples of each of the following sign types showing typical quality, workmanship and color: all sign types included in project. Approved samples may be installed in the work, provided each sample is identified and location recorded.

1.4.2 Detail Drawings

Submit detail drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, mounting height, shape and thickness of materials, and details of construction. Include a schedule showing the location, each sign type, and message.

1.4.3 Sign Fabricator

Sign Fabricator to follow room number strategies created by designer. The room numbering system to be reviewed and approved by the Contracting Officer and command end users during the shop drawing phase, and prior to fabrication.

1.4.4 Cybersecurity

a. The Risk Management Framework (RMF) is the process by which information systems are accredited for operation by a designated official from the Using Military Department. It is the standard process under which all DoD information systems achieve and maintain their Authority To Operate. The cybersecurity process is documented in DOD 8510.01 and NIST SP 800-82. Refer to UFC 4-010-06 and DODI 8500.01 for additional requirements.

b. All systems that are IP addressable or interface with the Assured Network required certification to operate. Coordinate with the Government to initiate and complete the accreditation process.

c. Cybersecurity requires input from the system vendor or provider and support from the local IMD. The local IMD-IA office is the point of contact for all Cyber Security requirements. The local CMIO is the point of contact for all clinical and functional system requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Package materials to prevent damage and deterioration during shipment, handling, storage and installation. Deliver products to the jobsite in manufacturer's original packaging and store in a clean, dry area in accordance with manufacturer's instructions.

1.6 WARRANTY

Provide manufacturer's warranty to repair or replace defective interior signage materials and workmanship for a period of 2 years from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION AND DIRECTIONAL SIGNAGE SYSTEM

Provide signs, plaques, directories, and dimensional building letters that are standard products of manufacturers regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letter forms and graphics true and clean.

2.1.1 Standard Room Signs

Provide signs that include tactile letters, symbols and Braille for interior rooms or spaces where the sign is not likely to change over time. Tactile text descriptions are required for pictograms that are provided to identify a permanent room. Examples include interior signs that label restrooms, stairs, room numbers or letters, and room names. These permanent room signs can include paper inserts for updatable information.

2.1.1.1 Tactile Letters, Symbols and Braille

Provide ADA compliant material per 36 CFR 1191 which is raised 1/32 inch from the first surface, has a minimum 5/8 inch in height and is an ADA acceptable font. The color of the tactile letters is required to contrast with the sign face color per ADA standards. The ADA required Braille has a minimum durometer reading of 90. All raised letters, numbers and symbols are to comply.

2.1.2 Directional Signs

Directional signs provide arrows with messages which point to critical destinations such as departments, offices, or other pertinent destinations. These can be a panel sign system with a series of permanently attached messages or a modular system with updatable inserts. Directional signs have header panels with applied or direct print messages.

2.1.3 Message Inserts

Provide updatable message inserts covered with a clear matte 0.015 inch vinyl protective overlay. The insert is typeset message laser printed on paper card stock. Provide software with message template for creating text and symbols for computers identified for Government production of paper inserts after project completion. Manufacturer is required to offer online ordering capabilities to facilitate and expedite ordering packages

of replacement, color-coated paper inserts. Furnish one device to assist in removing face sheet. Provide sliding inserts that slide horizontally exposing different graphic information as identified on the drawings.

2.1.4 Type of Mounting for Signs

Provide surface mounted signs mounted with manufacturer's standard (1/6 inch) 1.59 mm thick closed cell vinyl foam with adhesive backing. Adhesive must be transparent, long aging, high tech formulation on two sides of the vinyl foam. Double-faced tape consisting of acrylic adhesive on polyurethane foam used in conjunction with silicone adhesive. Provide signs with aluminum ceiling/projecting mount attachment extrusion to secure to ceiling or wall surface, along with matting ceiling/projecting mount track extrusion for hanging, projecting, and double-sided signs. Provide mounting for ceiling/projecting mount attachment extrusion by mechanical fasteners, selected based on wall or ceiling conditions. Mount track extrusion hinges over width of mount attachment and secured with 3.5 by 0.06 mm (6-32 inch) by 6 mm (1/4 inch) cone point stainless steel set screws.

2.1.5 Character Proportions and Heights

Letters and numbers on signs conform to 36 CFR 1191.

2.2 GRAPHICS

Provide signage graphics for modular signs to the following:

2.2.1 First Surface Copy Direct Print (Non-Tactile)

Message may be applied to panel using a direct print process. Original art is defined as artwork that is a first generation reproduction of the specified art. Provide clean edges and corners.

2.2.2 Photopolymer

Integral graphics and Braille achieved by photomechanical stratification processes. Provide photopolymer used for ADA compliant graphics of the type that has a minimum durometer reading of 90. Tactile graphics are raised 1/32 inch from the first surface of plaque by photomechanical stratification process.

2.3 COLOR, FINISH, AND CONTRAST

Provide color as specified in Section 09 06 00 SCHEDULES FOR FINISHES. Finish of eggshell, matte, or other non-glare finish for all signs as required in handicapped-accessible buildings.

PART 3 EXECUTION

3.1 INSTALLATION

Install signs plumb and true and in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Submit operating instructions outlining the step-by-step procedures required for system operation. The instructions include simplified diagrams for the system as installed, the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Provide each set permanently bound

with a hard cover. The following identification must be inscribed on the covers: "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number. Submit in accordance with Section 01 78 23 OPERATING AND MAINTENANCE DATA. Mounting height and mounting location complies with 36 CFR 1191. Install required blocking. Do not install signs on doors or other surfaces until finishes on such surfaces have been installed. Signs installed on glass surfaces are installed with matching blank back-up plates in accordance with manufacturer's instructions.

Do not install items that show visual evidence of biological growth.

3.1.1 Anchorage

Provide anchorage in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown includes slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Provide exposed anchor and fastener materials compatible with metal to which applied with matching color and finish.

a. Signs mounted to painted gypsum board surfaces must be removable for painting maintenance.

b. Install signs to workstation panels with panel clips.

3.1.2 Protection and Cleaning

Protect the work against damage during construction. Adjust hardware and electrical equipment for proper operation. Clean glass, frames, and other sign surfaces at completion of signage installation in accordance with the manufacturer's written instructions.

-- End of Section --

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SECTION 10 26 00

WALL AND DOOR PROTECTION
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D256	(2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D543	(2020) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F476	(2014) Standard Test Methods for Security of Swinging Door Assemblies
ASTM G21	(2021-e1) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(2005; R 2021) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards

SD-03 Product Data

Corner Guards

SD-04 Samples

Corner Guards

SD-06 Test Reports

Fire Resistance Rating

SD-07 Certificates

Indoor air quality for adhesives

SD-10 Operation and Maintenance Data

Corner Guards, Data Package 1; G

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality

1.3.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this section. Provide current product

certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Store materials at approximately 70 degrees F for at least 48 hours prior to installation.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a 1 year period from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, provide wall and door protection items that are standard products of a single manufacturer and furnished as detailed. Drawings show general configuration of products required.

Submit detailed shop drawings of each wall and door protection item indicated. Include elevations, dimensions, clearances, details of construction and anchorage, and details of joints and connections.

Submit manufacturers' descriptive product data for each wall and door protection item indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for each wall and door protection item indicated in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded PVC free acrylic vinyl conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance must be 18 ft-lbs/sq. inch when tested in accordance with ASTM D256, (Izod impact, ft-lbs per sq inch notched). Minimum impact resistance must be 49.62 ft-lbs/sq. inch when tested in accordance with ASTM F476.

2.1.1.2 Fire Resistance Rating

Provide the following surface burning characteristics when tested and labeled in accordance with ASTM E84 by a qualified testing agency: maximum flame spread of 25 and a smoke developed rating of 450 or less. Provide material rated as self extinguishing when tested in accordance with ASTM D635. Provide resilient material used for protection on fire rated doors and frames listed by the qualified testing agency performing the tests. Provide resilient material installed on fire rated wood/steel

door and frame assemblies tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly are not acceptable.

2.1.1.3 Integral Color

Provide colored components having integral color and matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Provide materials resistant to chemicals and stains reagents in accordance with ASTM D543.

2.1.1.5 Fungal and Bacterial Resistance

Provide materials resistant to fungi and bacteria in accordance with ASTM G21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Provide surface mounted corner guards, radius formed to profile shown. Provide corner guards that are 4 feet high. Furnish mounting hardware, cushions, and base plates. Provide assembly consisting of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer conforms to ASTM B221, alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of corner guards. Flush mounted type guards act as a stop for adjacent wall finish material. Furnish factory fabricated end closure caps for top and bottom of surface mounted corner guards. Provide flush mounted corner guards installed in fire rated wall that maintain the rating of the wall. Manufacturer to provide insulating materials that are an integral part of the corner guard system. Provide exposed metal portions of fire rated assemblies with a paintable surface.

2.3 TRIM, FASTENERS AND ANCHORS

Provide trim, fasteners and anchors for each specific installation as indicated.

2.4 FINISH

Submit samples indicating color and texture of materials requiring color and finish.

2.4.1 Resilient Material Finish

Provide resilient material finish of shadowgrain texture with colors in accordance with SAE J1545.

2.5 ADHESIVES

Provide adhesive for resilient material in accordance with manufacturers recommendations. Provide sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing

system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of SCAQMD Rule 1168, or VOC content requirements of GS-36. Provide certification of indoor air quality for adhesives.

2.6 COLOR

Provide color as specified in Section 09 06 00 SCHEDULES FOR FINISHES.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Install items on surfaces that are clean, smooth, and free of obstructions.

3.1.1 Corner Guards and Wall Guards

a. Mount guards as indicated in the drawings and in accordance with manufacturer's written installation instructions.

b. For wall guards, space brackets at no more than 3 feet on centers and anchor to the wall in accordance with the manufacturer's written installation instructions.

-- End of Section --

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SECTION 10 44 16

FIRE EXTINGUISHERS
11/19

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2021) Fire Code
NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 101	(2021) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.157	(2003) Portable Fire Extinguishers

UNDERWRITERS LABORATORIES (UL)

UL 299	(2012; May 2021) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fire Extinguishers

Accessories

Wall Brackets

Schedule

SD-03 Product Data

Fire Extinguishers

Accessories

Wall Brackets

Replacement Parts List

SD-04 Samples

Equipment Samples

SD-07 Certificates

Fire Extinguishers Certifications

Manufacturer's Warranty with Inspection Tag

1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

1.3.1 Samples

Provide the following equipment samples: One of each type of fire extinguisher being installed; one full-sized sample of each type of cabinet being installed; three samples of wall brackets and accessories of each type being used.

Use approved samples for installation, with proper identification and storage.

1.4 WARRANTY

Guarantee that Fire Extinguishers are free of defects in materials, fabrication, finish, and installation and that they will remain so for a period of not less than 5 years after completion.

Submit the manufacturer's warranty with inspection tag.

1.5 PROJECT SCHEDULE

For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

PART 2 PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: Fire Extinguishers; Accessories, and Wall Brackets.

2.1 SYSTEM DESCRIPTION

2.1.1 Types

Submit fire extinguishers certifications showing compliance with local codes and regulations.

Provide fire extinguishers conforming to NFPA 10. Provide quantity and placement in compliance with the applicable sections of NFPA 1, NFPA 101,

and 29 CFR 1910.157.

Provide dry chemical type fire extinguishers compliant with UL 299.

2.1.2 Material

Provide enameled steel extinguisher shell.

2.1.3 Size

10 pound extinguishers.

2.1.4 Accessories

Forged brass valve

Fusible plug

Safety release

Antifreeze

Pressure gage

PART 3 EXECUTION

3.1 INSTALLATION

Install Fire Extinguishers where indicated on the drawings. Verify exact locations prior to installation.

Provide extinguishers which are fully charged and ready for operation upon installation. Provide extinguishers complete with Manufacturer's Warranty with Inspection Tag attached.

Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

Comply with the manufacturer's recommendations for all installations.

3.2 PROTECTION

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

Submit replacement parts list indicating specified items replacement part, replacement cost, and name, address and contact for replacement parts distributor.

3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

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SECTION 12 50 00.13 10

FURNITURE AND FURNITURE INSTALLATION
08/17, CHG 1: 11/18

PART 1 GENERAL

Purchase and install furniture as identified within this specification. This specification section includes a Furniture, Fixtures and Equipment (FF&E) Package attachment.

The requirements of this specification also apply to systems furniture unless otherwise specified in Section 12 59 00 Systems Furniture.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM D4157	(2013; R 2017) Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials

BIFMA INTERNATIONAL (BIFMA)

ANSI/BIFMA X5.1	(2017) American National Standards For Office Furnishings - General Purpose Office Chairs
ANSI/BIFMA X5.3	(2007; R2012) American National Standards For Office Furnishings - Vertical Files
ANSI/BIFMA X5.4	(2012) American National Standards For Office Furnishings - Lounge Seating
ANSI/BIFMA X5.5	(2014) American National Standards For Office Furnishings -Desk Products
ANSI/BIFMA X5.6	(2016) American National Standards For Office Furnishings -Panel Systems

ANSI/BIFMA X5.9	(2012) American National Standards For Office Furnishings - Storage Units

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2021) Life Safety Code
NFPA 260	(2013) Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture
NFPA 265	(2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

STATE OF CALIFORNIA DEPARTMENT OF CONSUMER AFFAIRS, BUREAU OF ELECTRICAL AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION (BEARHFTI)

TB 117-2013	(2013) Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Storage Location; G

SD-02 Shop Drawings

Installation Drawings; G

Grommet; G

SD-03 Product Data

Product Data; G

Product Style Options; G

SD-04 Samples

Fabric and Finishes; G

SD-07 Certificates

Authorized Dealer; G

Certified Furniture Installers; G

Licensed Electrician; G

Certified Telecommunications Installer; G

Manufacturer's Certification; G

Warranty; G

SD-10 Operation and Maintenance Data

Furniture, Data Package 1; G

SD-11 Closeout Submittals

Energy Efficient Equipment

Reduced VOC's for Furniture

Recycled Content of Furniture

Bio-Based Content of Furniture

1.3 SERVICES

Provide services to include furniture purchase, field measuring, installation drawings, shipping and delivery coordination, receiving, inspection, submitting and processing freight and warranty claims, unpacking, storing, assembly, installation and other related activities or tasks for a complete and functional installation. Reference Section 01 45 04.10 06 CONTRACTOR QUALITY CONTROL for inspection requirements. The Contracting Officer must be allowed to participate in inspections. Develop project timelines and establish shipping, receiving and installation dates that coordinate with the building construction schedule. Hold at a minimum weekly team meetings to brief the project team, include the Contracting Officer. Notify the Contracting Officer immediately of any scheduling problems, discontinued furniture items including fabrics and finishes, or other conditions which may cause delays, and recommend available substitutes, solutions, and provide updated timeline to coordinate with building construction schedule. Substitutes and solutions must comply with the specification and be approved by the Contracting Officer.

1.4 FURNITURE PURCHASE

Purchase furniture, including checking accuracy of all acknowledgements and schedules from manufacturers and making necessary corrections to insure that the manufacturer has a correct understanding of the order and requirement. Purchase furniture from the open market. The furniture provided needs to be available on the GSA Schedules to assist the User with future purchases. GSA information is provided FOR INFORMATIONAL PURPOSES ONLY. It is encouraged to solicit and provide GSA pricing on furniture. Compete the furniture purchase by obtaining a minimum of (3) separate proposals. Furniture is subject to FAR clause 52.236-5 Materials and Workmanship.

1.5 ALTERNATE DESIGN

When a manufacturer's product is unable to provide desk and workstation configurations and filing/storage that conform exactly to the furniture layouts shown in the contract drawings and specifications, alternate designs may be submitted for consideration by the Contracting Officer. Alternate designs must meet or exceed the following criteria. Alternate designs that are submitted but do not meet these criteria will be rejected.

1.5.1 Desk and Workstation Size and Configuration

The alternate design must provide desks and workstations of the same basic size and configuration shown, with only the sizes of the individual components within the desk and workstation changed to meet the standard product of the manufacturer.

1.5.2 Filing and Storage Size and Configuration

The alternate design must provide filing and storage of the same basic size and configuration shown, with only the size changed to meet the standard product of the manufacturer. The storage capacity must not be reduced.

1.5.3 Furniture Requirements

The furniture provided must comply with the drawings, specifications, and the requirements identified in the FF&E Package Attachment.

1.5.4 Layout

The storage capacity, number of desks and workstations, number of persons accommodated, width of aisles, and functionality must be maintained. Layout must comply with NFPA 101 and 36 CFR 1191.

1.6 AUTHORIZED DEALER, CERTIFIED FURNITURE INSTALLERS, LICENSED ELECTRICIAN AND CERTIFIED TELECOMMUNICATIONS INSTALLER

When required by the furniture manufacturer, furniture must be installed by an authorized dealer and a certified furniture installation crew must be used on the project. All furniture requiring hardwiring must be completed by a licensed electrician. Communications installers must be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level or have a minimum of 3 years experience in the installation of the specified cables and components. All installers, furniture, electrical and communications, must be on-site if questions arise. Submit copies of authorized dealer, furniture

installation crew, licensed electrician and certified telecommunications installer certifications.

1.7 DELIVERY, STORAGE AND HANDLING

1.7.1 Delivery

Deliver furniture to the job site in manufacturer's original packaging or blanket wrapping. Original packaging must be marked with the manufacturer name, item identification, and project reference clearly marked.

1.7.2 Furniture Inspection

Inspect furniture and provide notification of damage within the time frame required by the shipping company while carrier is still on-site. Complete claims for concealed damage within the time frame required by the shipping company and furniture manufacturer. A claim file must be maintained that documents each claim. Forward copies of claims to the Contracting Officer on a daily basis.

1.7.3 Storage

Storage space is not available on-site and furniture must be stored at an off site location. Provide any storage space required for furniture and transport stored furniture to the project site for installation. Storage location must be approved by the Contracting Officer at the time of the furniture order. If storage is required, furniture must be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, in a manner that permits easy access for inspection and handling, and in an environment in accordance with furniture manufacturers instructions.

1.7.4 Furniture Staging Area

Coordinate location of the furniture staging area with the Contracting Officer.

1.8 WARRANTY

Provide manufacturer performance guarantees or warranties for single-shift service and include parts, labor and transportation as follows, unless otherwise noted:

a. Systems Furniture - see Section 12 59 00 SYSTEMS FURNITURE

b. Desks and Workstations - 12 year minimum

c. Filing and Storage - 12 year minimum

d. Seating

(1) Seating, unless otherwise noted - 10 year minimum

(2) 24/7 Seating (multiple shift use) - 10 year minimum

(3) Seating Mechanisms and Pneumatic Cylinders - 10 year minimum

(4) Lounge Seating - 10 year minimum

(5) Stacking Chairs - 10 year minimum

e. Tables

(1) Unless otherwise noted - 10 year minimum

(2) Table Mechanisms - 5 year minimum

(3) Table Ganging Device - 1 year minimum

f. Miscellaneous

(1) Fabric - 3 year minimum

(2) LED Task Lighting - 5 year minimum

(3) Task Lighting - 3 year minimum

Provide items not listed with a 1 year minimum. When manufacturers standard performance guarantees or warranties exceed the minimum requirements identified, provide the standard performance guarantee or warranty. Submit manufacturer's warranty information for all furniture items.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Energy Efficient Equipment

Coordinate requirement for energy efficient equipment, such as appliances and lighting.

2.1.2 Reduced VOC's for Furniture

Coordinate requirement for reduced VOC requirements for furniture and provide documentation in accordance with REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.1.3 Recycled Content of Furniture

Coordinate requirement for recycled content for furniture and provide documentation in accordance with REPORTING paragraph RECYCLED CONTENT.

2.1.4 Bio-Based Content of Furniture

Coordinate requirement for biobased content for furniture and provide documentation in accordance with REPORTING paragraph BIO-BASED PRODUCTS.

2.2 REFERENCE TO MANUFACTURER NAMES AND COLORS

Where product and color is shown as being specific to one manufacturer in the FF&E Package Attachment, an equivalent color or product by another manufacturer may be submitted for approval. Manufacturers, style lines, model numbers, finish, and fabric information are provided to establish design intent and are not intended to limit the selection of equal

products and colors from other manufacturers.

2.3 FURNITURE REQUIREMENTS

Use the FF&E Package Attachment in conjunction with the drawings and specifications for the furniture requirements. Systems furniture is specified in Section 12 59 00 SYSTEMS FURNITURE. Provide furniture from manufacturer's standard product as shown in the most current published price list or amendment. Furniture provided must be part of current line as indicated with no intent to discontinue within two years. Provide furniture that is intended for commercial use not residential. submit product data for all furniture items, to include catalog cuts, brochures, product information, and other necessary literature to indicate compliance with specifications. Submit each grouping of similar type items in a single submittal. When applicable, include GSA schedule information to confirm that items are available on GSA schedule. Tag product data sheets with applicable furniture item code and name. Submit data for all product style options for selection when options are available. This applies to but is not limited to furniture items that have options such as edge details, hardware options, and grommet colors. Submit manufacturer's certification stating that furniture meets the specifications.

2.3.1 EXISTING FURNITURE (GOVERNMENT FURNISHED/CONTRACTOR INSTALLED-GF/CI)

2.3.1.1 Existing Furniture to be Reused

Disassemble, pack, move, store, transport to the project site and install existing furniture identified to be reused. This includes disconnecting and reconnecting furniture electrical connections at the building source. Coordinate with electrician for safe terminations or removal of disconnected building electric system supply circuits.

2.3.1.2 Existing Furniture that is Not Reused

Disassemble and have ready for excessing and pick up any furniture identified as not to be reused. Furniture will be picked up by Government directed vendors. Coordinate pick-up times with Contracting Officer and User. This includes disconnecting furniture electrical connections at the building source. Coordinate with electrician for safe terminations or removal of disconnected building electric system supply circuits. Protect all items from damage and provide security and weather protection prior to and during relocation.

2.3.1.3 Existing Furniture Communications

Remove existing Information Technology (IT) cables (i.e., SIPRNET, NIPRNET, J-WIC'S, etc.) and telephone wiring from existing furniture systems identified to be reused or requiring excessing.

2.3.2 Construction

a. Provide furniture that complies with the following testing requirements:

(1) ANSI/BIFMA

(a) Office Seating - ANSI/BIFMA X5.1

(b) Vertical Files - ANSI/BIFMA X5.3

(c) Lounge Seating - ANSI/BIFMA X5.4

(d) Desk Products - ANSI/BIFMA X5.5

(e) Panel Systems - ANSI/BIFMA X5.6

(f) Storage - ANSI/BIFMA X5.9

(2) Flammability

(a) Systems furniture and workstation panel components must meet requirements for flame spread and smoke development as specified by NFPA 101 except as follows. Conduct testing in accordance with either ASTM E84 or UL 723 on the entire assembled panel of the worst case (most combustible) combination of fabric and interior construction. In addition, fabric must meet the requirements of NFPA 265. Panel flame spread shall not exceed 25 for Class A, and panel smoke development shall not exceed 450 for Class A, B, and C.

(b) Upholstered furniture must comply with TB 117-2013 or NFPA 260.

b. Provide furniture with no rough or sharp edges or exposed connections. Clips, screws, and other construction elements must be concealed wherever possible.

c. Items such as desks, workstations and systems furniture must include all necessary components to be structurally sound and must not be attached to the wall unless specified to be wall mounted in the contract documents.

d. Desks, workstations, storage, and tables must have leveling devices to compensate for uneven floors.

e. The underside of desks, workstations, and tables must be completely and smoothly finished.

f. The backside of freestanding desks, workstations, and storage must be finished.

g. Provide chair casters and glides appropriate for the floor material they are located on, such as carpet and resilient flooring.

2.3.3 Locks and Keying

a. All drawers and doors, including but not limited to overhead storage cabinets, storage towers, supply cabinets, storage cabinets, desk and workstation pedestals, and filing cabinets must be lockable.

b. Key each desk and workstation in an office differently and key locks within each desk and workstation alike.

c. Furniture storage components in private offices must be keyed alike. Key each private office differently.

d. Provide field changeable lock cylinders in desks and workstations with a minimum of 100 different key options. Number keys and lock cylinders for ease of replacement or clearly label locks with a key number, except for those manufacturers who have removable format locks.

e. Drawers within a pedestal must be lockable either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal.

f. Central file and storage units which are grouped together but are not a part of a workstation must be keyed alike unless otherwise specified.

g. Provide two keys for each workstation when components are keyed alike. Also provide two keys for each miscellaneous item such as filing cabinets, supply cabinets, storage cabinets, and similar type furniture items.

h. Provide three copies of each master key to the Contracting Officer.

i. Leave keys in locks.

2.3.4 Receptacle Bodies and Device Cover Plates

Provide furniture panel faceplates and receptacle body types as specified in 12 59 00 SYSTEMS FURNITURE.

2.3.5 Fabric and Finish

Submit samples of all furniture fabric and finishes. Samples must be actual samples, not photographic representations, size must be a minimum of 3 by 3 inches. If necessary, provide larger size samples to clearly represent pattern. Label samples with fabric or finish code, furniture item code and name, manufacturer name, and color information. Fabric samples must also be labeled with fiber content and double rub testing information.

2.3.5.1 Fabric

a. Fabric must be from manufacturer's standard line and graded-in textile manufacturer's fabrics, and customer's own material (COM).

b. Provide a mid grade fabric, unless otherwise noted. Example: manufacturer available grades 1 through 4 (even number of grades), provide grade 3; manufacturer available grades A through D (even number of grades), provide grade C; manufacturer available grades A through E (odd number of grades), provide grade C (middle grade).

c. Provide a topical or inherent soil retardant treatment where indicated.

d. Comply with double rub testing as specified in the FF&E Package Attachment. Perform double rub testing in accordance with the ASTM D4157 Wyzenbeek Method.

e. Provide vinyl, polypropylene or similar type fabric for seating only if allowed in FF&E Package Attachment.

f. Pattern:

(1) Provide patterns as specified in the FF&E Package Attachment.

g. See FF&E Package Attachment for additional information.

2.3.5.2 Finishes

Provide furniture finishes as listed below unless otherwise noted:

a. Finishes must be able to be cleaned with ordinary household cleaning solutions. Wood finishes must be able to be cleaned with damp cloth as directed by the manufacturer.

b. The finish of steel surfaces must be the manufacturer's most durable finish such as factory powder coat or baked enamel.

c. Grommet colors must be compatible and coordinated with desk, workstation, and table finish colors.

d. Plastic laminate worksurfaces and table tops must be neutral in color and must have a pattern to help hide soiling.

e. See FF&E Package Attachment for additional information.

2.4 FURNITURE LAYOUT

Provide furniture layout as indicated.

PART 3 EXECUTION

3.1 BUILDING EXAMINATION

Become familiar with details of the work, inspect all areas and conditions under which furniture is to be installed, and coordinate scheduling of dedicated elevators and docks. Notify the Contracting Officer in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected.

3.2 BUILDING PROTECTION

Protect building surfaces to prevent soiling and damage during delivery and installation. Any soiling and damage that occurs to the building during the installation of furniture must be cleaned and repaired, or replaced to its original condition and must be approved by the Contracting Officer.

3.3 INSTALLATION

3.3.1 Installation Drawings

Installation drawings must include furniture layout, critical dimensions and locations of electrical and communications. Furniture layouts shall reflect field verified conditions. Drawings must be at 1/4 inch = 1 foot scale, unless otherwise specified. Provide typical plans and isometrics/elevations of desks and workstations at a scale of 1/2 inch = 1 foot. When applicable, provide desk and workstation electrical and communications locations. When applicable include controlled-circuit identification for each furniture receptacle and coordinate with the building electrical system circuits in accordance with ASHRAE 90.1 - IP. Critical dimensions include, but are not limited to clearances and aisle widths. Drawings must include layout for furniture systems workstations for coordination purposes. Label furniture with furniture item code identified in this specification. Submit grommet locations.

3.3.2 Furniture Installation Procedures

Complete installation in accordance with manufacturer's installation instructions, assembly manuals, warranty requirements and approved installation drawings. Also comply with the following requirements:

a. Use material handling equipment with rubber wheels.

b. Furniture and components must be installed level, plumb, square, and with proper alignment with adjoining furniture.

c. Match keys to locks and check locking mechanisms.

d. Check drawers, doors, lighting, and other operable items and mechanisms for proper operation.

e. Remove all protective wrapping tape, residue, and related type items.

f. Securely interconnect furniture components where required.

g. Securely attach and anchor furniture components to the building when required.

h. Securely anchor furniture such as shelving and storage units to the building when required by the manufacturer.

i. All items with an electrical plug, such as but not limited to task lighting and tables with electrical power, must be fully operational.

j. All hardwired furniture, such as but not limited to furniture systems, must be fully operational. Verify that voltage is present in electrical outlets. Verify controlled-circuit outlets are properly configured in accordance with the installation drawings.

k. Furniture must not block SIPRNET jacks or the jack enclosures on walls. Report conflicts to Contracting Officer to discuss resolution.

l. Upon completion of installation, all furniture must be completely cleaned, finished, leveled, aligned, operational and functional.

3.4 CLEANING

Remove all packing materials and other trash from the job site. Upon completion of installation, all products must be clean, including inside all drawers and doors, and the area must be free of debris and left in a clean and neat condition. Any defects in or damage to furniture must be repaired or replaced and approved by the Contracting Officer. Damaged products that cannot be satisfactorily repaired must be replaced. Correct any problems with assembly and installation. Prior to any furniture repair, replacement, and/or assembly and installation corrections, protect the building surfaces.

3.5 OPERATION AND MAINTENANCE MANUALS

Submit the Furniture, Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and include the following:

3.5.1 Assembly Manuals

Describe assembly and re-configuration procedures. Provide three sets of installation video tapes if available.

3.5.2 Installation Instructions

Provide a copy of the instructions used to install the furniture. Also describe any special procedures or helpful hints learned during the installation process.

3.5.3 Maintenance Manuals

Describe proper cleaning and minor repair procedures, include cleaning instructions for fabrics.

3.5.4 Electrical System Manuals

Describe the functions, configuration, and maintenance of the furniture electrical system (power, communication, and data). This information may be included in the assembly or maintenance manuals.

3.5.5 Special Tools

Provide three sets of special tools necessary for assembly and disassembly of furniture and components from each manufacturer. Mark tool(s) with manufacturer and product information.

3.5.6 Furniture Drawings

Provide hard copy and electronic, showing installed furniture layout. Include all modifications. Provide electronic copies on a CD-ROM. Coordinate type (such as but not limited to Microstation, AutoCad and Revit) and version required with User. Include critical dimensions, and locations of building and furniture electrical and communications. Provide drawings at 1/4 inch = 1 foot scale, unless otherwise specified. Provide typical plans and isometrics/elevations of workstations at a scale of 1/2 inch = 1 foot. Code all furniture with furniture item code identified in this specification.

3.5.7 Furniture Listing

Provide complete listing, hard copy and electronic, of furniture provided. Include all modifications. Provide electronic copies on a CD-ROM. Coordinate type of electronic file required with User (such as but not limited to Word and Excel). Listing must include furniture item code and name used in FF&E Package, part/model numbers, fabrics and finishes for all components furnished. Organize listing by item name and code and provide building totals.

3.5.8 Order Form Documentation

Provide Order Form Documentation with Purchase Order number and project name and location to allow the User to follow up on warranty issues and help with future purchases.

3.5.9 Key Control System

Key Control System. Provide system in excel format; indicate lock number,

room number and location of lock within rooms if more than one lock number.

-- End of Section --

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SECTION 12 59 00

SYSTEMS FURNITURE
08/17, CHG 1: 08/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C423	(2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C1048	(2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E290	(2014) Bend Testing of Material for Ductility

BIFMA INTERNATIONAL (BIFMA)

ANSI/BIFMA M7.1	(2011; R 2016) Test Method for Determining VOC Emissions from Office Furniture Systems, Components and Seating
ANSI/BIFMA X5.5	(2014) American National Standards For Office Furnishings -Desk Products
ANSI/BIFMA X5.6	(2016) American National Standards For

	Office Furnishings -Panel Systems
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2016) Wiring Devices Dimensions Specifications
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 101	(2021) Life Safety Code
NFPA 265	(2019) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls
SCIENTIFIC CERTIFICATION SYSTEMS (SCS)	
SCS	SCS Global Services (SCS) Indoor Advantage
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)	
TIA-568.2	(2018d) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-569	(2019e) Telecommunications Pathways and Spaces
U.S. DEPARTMENT OF ENERGY (DOE)	
Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines
UNDERWRITERS LABORATORIES (UL)	
UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 1286	(2008; Reprint Apr 2021) UL Standard for Safety Office Furnishings
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Warranty; G

Workstations

Power and Communications

Communications

Recycled Content for system furniture components

Energy Star Label for Task Lighting

SD-04 Samples

Workstations; G

Mock-up; G

Samples

SD-06 Test Reports

Selected Components; G

Panel Acoustics; G

Fire Safety; G

Electrical System; G

SD-07 Certificates

Workstations

SD-10 Operation and Maintenance Data

Assembly Manuals; G

Maintenance Manuals; G

Cleaning; G

Electrical System; G

Maintenance Agreements

Installation; G

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Office Furniture Systems and Seating

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold, ANSI/BIFMA M7.1 Certification or provide certification by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 QUALITY ASSURANCE

1.4.1 General Safety

Provide workstation products free of rough or sharp edges. Provide panel supported components with a positive, integral locking device which secures components without the use of additional screws or clamps to prevent the components from being accidentally pulled or knocked off the panels. Provide desk-based workstation components with an option for a positive, integral locking device that secures components to the base units.

1.4.2 Fire Safety

Components must meet requirements for flame spread and smoke development as specified by NFPA 101 except as follows. Conduct testing in accordance with either ASTM E84 or UL 723 on the entire assembled panel of the worst case (most combustible) combination of fabric and interior construction. In addition, fabric must meet the requirements of NFPA 265. Do not exceed 25 for Class A for panel flame spread and 450 for Class A, B and C panel smoke development .

1.4.3 Electrical System

Task lights are required to be UL listed and installation of task lighting must meet the requirements of NFPA 70. The electrical system must meet the requirements of UL 1286. Submit three sets of electrical system manuals describing the functions, configuration, and maintenance of the electrical system (power, communications, and data). This material may be included in the Assembly or Maintenance manuals at the Contractor's option.

1.4.4 Detail Drawings

Submit detail drawings showing communications, electronic data processing (EDP) and local area network (LAN); locations may be provided as a separate submittal from remaining workstation drawings. Provide drawing requirements, which are the furniture manufacturer's responsibility, as a single submittal. Provide electronic drawings to the user for future re-configuration in the software package requested by the user. Include

in the electronic drawings all modifications made during installation. As a minimum, submit the following:

a. Overall reference drawings: Drawings showing workstation locations and overall plan view within each floor in a scale of 1/8 inch = 1 foot. Layouts must reflect field verified conditions and clearly illustrate the overall space planning concept and intent.

b. Installation drawings: Drawings showing workstations, panels, components, and plan view within each floor. Identify workstations by workstation type; submit drawings showing the proposed workstation installation at a scale of 1/4 inch = 1 foot, unless otherwise specified. Installation drawings must reflect field verified conditions.

c. Workstation elevations: Dimensioned workstation elevations showing each type of workstation with panel frame configurations and all components identified with manufacturer's catalog numbers. Draw elevations at 1/2 inch = 1 foot scale.

d. Panel drawings: Panel drawings showing locations and critical dimensions from finished face of walls, columns, panels, including clearances and aisle widths. Key assemblies to a legend which includes width, height, configuration and composition of frame covers finishes and fabrics (if different selections exist within a project), power or nonpower, connectors and wall mount hardware. Coordinate panel placement with location of electrical, voice/date LAN, SIPRNet, NIPERNet, mechanical and fire protection fixtures. Drawings must reflect field verified conditions.

e. Electrical drawings: Drawings showing power provisions including type and location of feeder components (service entry poles, base or ceiling feeds), activated power receptacles and other electrical components. Wiring configuration (circuiting, switching, internal and external connections) identified and a legend provided as applicable. Identify which receptacles in typical furniture configurations will be connected to controlled building power circuits as applicable to meet ASHRAE 90.1 - IP requirements. Coordinate with electrical drawings.

f. Wire management capacity drawings.

g. Communication drawings showing telephone provisions: Drawings indicating the type and location of feeder components and communications jacks with wiring configuration identified where applicable.

h. Communication drawings showing electronic data processing provisions: Drawings indicating the type and location of feeder components, communications jacks, or accessories with wiring configuration identified where applicable.

i. Communication drawings showing local area network provisions: Drawings indicating the type and location of feeder components and data jacks with extra ports for future expansion with wiring configuration identified where applicable.

j. Communications drawings indicating the TIA-568.2 pin/pair assignment that will be used for communications outlet as coordinated with the COR.

k. Reflected ceiling plan for projects specified with power poles.

l. Drawings indicating cabling is protected at all transition points, and that metallic separation is provided between telecommunication and power wiring in the utility columns and systems furniture track in accordance with TIA-569 and NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Remove furniture from packaging and store in an unoccupied, dry location that is ventilated. Storage shall be free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

1.6 WARRANTY

Warrant the systems furniture for a minimum period of lifetime with the following exceptions: fabrics and other covering materials, and paper handling products for 3 years, LED drivers/power supplies for 5 years, and electromagnetic ballasts for 3 years. Warranties must be signed by the authorized representative of the manufacturer. Present warranties, accompanied by document authenticating the signer as an authorized representative of the guarantor, to the Contracting Officer upon the completion of the project. Guarantee that the workstation products and installation are free from any defects in material and workmanship from the date of delivery. Submit two copies of the warranty.

1.7 MAINTENANCE AGREEMENTS

Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse and avoid landfilling and burning reclaimed materials. When such a service is not available through a manufacturer, local recyclers should be sought after to reclaim the materials.

PART 2 PRODUCTS

2.1 MATERIALS

Provide System Furniture Components with a minimum of 55 percent recycled content. Provide data identifying percentage of recycled content for system furniture components.

Provide certification of indoor air quality for Office Furniture Systems and Seating.

2.2 SYSTEM DESCRIPTION

2.2.1 Workstations

This specification establishes the minimum requirements for the acquisition and installation of a complete and usable system of workstations composed of panels, freestanding work surfaces or base units,

supporting components, electrical hardware, communications, special electrical features, and accessories. Provide workstation requirements and configurations in accordance with the furniture layout and typical workstation types shown in drawings and specified herein. Provide components and hardware from a single manufacturer that are standard products as shown in the most recent published price lists or amendments. Proposed product must be part of the manufacturer's current line with no intent to discontinue within two years. Submit complete listing of part/model numbers for all components to be provided, including names and codes of components referenced on updated drawings. Provide electrical components from a single manufacturer to the extent practicable (different types of components may be of different manufacturers, but all units of a given component must be from a single source). Conformance with NFPA 70, UL 1286, NFPA 101, and 36 CFR 1191 is required. Coordinate the work of this section with that to be performed under other sections. This specification may include items which are not manufactured by the furniture manufacturer; provide any such items under this section. Submit two complete sets of certificates attesting that the proposed workstation meets specified requirements. Date the certificate after the award of the contract, include the name of the project, and list specific requirements being certified.

2.2.2 Samples

Submit samples as required to obtain final approval. The Government reserves the right to reject any finish samples that do not satisfy the technical or color requirements. Work can not proceed without sample approval in writing from the Contracting Officer. Submit four sets of the finish samples listed below:

a. Panel, tackboard and overhead door fabric. Minimum 6 by 6 inches with label designating the manufacturer, pattern, color, fiber content, fabric width, fabric weight, fire rating, and use (panel and/or tackboard).

b. Workstation component finishes. Minimum 2-1/2 by 3 inches with label designating the manufacturer, material composition, thickness, color, and finish.

c. Panel glazing. Glazing samples with label designating the material and safety ratings.

2.2.3 Mock-up

Submit a Mock-up of an actual workstation reflecting approved finishes and fabrics. Locate the mock-up installation at approved off-site location. Do not order product for the project until the mock-up has been approved. Submit manufacturer's product and construction specifications which provide technical data for furniture system and components specified, including task lighting and illumination performance information. Include adequate information in the literature to verify that the proposed product meets the specification. Review of the mock-up may result in adjustments to the product, layout and finishes. The approved mock-up can be used in installation.

2.2.4 Alternate Design

Manufacturers who are unable to provide workstations that conform exactly to the furniture layouts and typical workstation types shown in the

contract drawings, may submit alternate designs for consideration by the Contracting Officer. Alternate designs must meet or exceed the following criteria. Alternate designs that are submitted but do not meet these criteria will be rejected. In the alternate design provide workstations and components of the same basic size and configuration shown, with only the sizes of the individual components within the workstation changed to meet the standard product of the manufacturer or site conditions.

2.2.4.1 Component Requirements

Provide the types of components or elements as shown on the drawings and as specified in PART 2 PRODUCTS of this specification. Do not reduce the storage capacity, number of workstations accommodated, width of aisles, or workstation configuration.

2.2.4.2 Wiring Configuration

Alternate configurations shall support the circuiting and connection capabilities identified under the provisions pertaining to power distribution of paragraph POWER AND COMMUNICATIONS. Generally any alternate will be acceptable which involves only a variation in size or quantity that exceeds the specified configuration. NO SHARED NEUTRALS ALLOWED.

2.2.5 Performance Requirements

Panels, frames and frame covers, connection system, work surfaces, pedestals, shelf units, overhead door cabinets, lateral files, locks, accessories, and miscellaneous hardware must meet testing as specified. ISO 9001 certified manufacturers may perform in-house testing. Manufacturers not ISO 9001 qualified will be required to produce testing by an independent testing laboratory. Component specific requirements are listed in appropriate paragraphs.

2.2.5.1 Selected Components

Workstation conformance to ANSI/BIFMA X5.5 and ANSI/BIFMA X5.6 is required with the following exceptions: Panels, or panel supported components conformance to ANSI/BIFMA X5.6 is required. Representative items will be selected for testing based on worst case situations (i.e., the deepest and widest work surface or shelf).

2.2.5.2 Panel Acoustics

Provide acoustical panels with a minimum noise reduction coefficient (NRC) of 0.65 when tested in accordance with ASTM C423 and a minimum sound transfer coefficient (STC) of 14 when tested in accordance with ASTM E290. Conduct the test on the entire assembled panel, full face area (the complete core, adhesive, decorative fabric, frame and joining components).

2.2.5.3 Panel Glazing

Tempered glass must conform to ANSI Z97.1 and ASTM C1048, Kind FT, Condition A, Type I, Class 3 - Light reducing, tinted or translucent.

2.2.6 Pattern and Color

Provide pattern and color of finishes and fabrics for panel systems, components, and trim in accordance with the Furniture, Fixtures, and

Equipment Package.

2.3 SYSTEMS FURNITURE

2.3.1 Panel System Components

Supply accessories and appurtenances for a completely finished panel assembly with the system. Provide a system capable of structurally supporting cantilevered work surfaces, shelves, files, overhead cabinets, and other components in the configurations shown on the drawings plus more than one fully loaded component per panel per side. Provide panels that are tackable, stackable with a system capable of lowering or raising the overall panel assembly height at horizontal connections by removing or adding panel-frames on-site without disturbing adjacent panel components. Segments will be field removable from both sides of the panel. Provide capability for worksurfaces to attach to the panels in 1 - 2 inch increments. Provide a panel system that is available in a variety of nominal widths and heights as designated on the drawings. Measure heights from the finished floor to the top of the panel. Supply powered and nonpowered panels that are compatible in height. Coordinate panel heights with the HVAC and electrical designs. Minimum panel thickness is 3 inches thick. System to have 100 percent off-modular capability with no defacement of any element caused by components when used in an off-modular application. Unique panel frames must not be required for off modular connections. Submit three sets of Assembly Manuals describing assembly and reconfiguration procedures.

2.3.2 Panel Finishes

Provide panels in the following options: safety glazed, tackable fabric. Exposed panel trim to have a factory baked enamel or epoxy powder finish. Provide each fabric-faced panel with a seamless width of fabric stretched over the entire face of the panel. The fabric color throughout the installation must be consistent. Curved panels may use adhesives on curved sections. Attach the fabric securely and continuously along the entire perimeter of the panel and allow for easy removal and replacement in the field (with the exception of curved panels). Fabric must be factory installed with 100 percent polyester panel fabric content.

2.3.3 Raceways

Provide raceways and covers as an integral part of the panel whether powered or nonpowered. Magnet held base covers will not be accepted.

2.3.4 Leveling Glides

Provide precise alignment of adjacent panels and include leveling glides to compensate for uneven floors. Provide quantity and location of leveling glides as recommended by the manufacturer. A minimum 3/4 inch adjustment range is required.

2.3.5 Connection System

Provide connectors which accommodate a variety of configurations as indicated on the drawings to include: a straight line connection of 2 panels (180 degrees), corner connection of 2 panels (90 degrees), T connection of 3 panels (90 degrees), cross connection of 4 panels (all 90 degrees). Provide tight connections with continuous visual and acoustical seals. Plastic, painted metal, fabric or wood finish connections are

required to match system. Provide connector system that allows removal of a single panel within a typical workstation configuration, without requiring disassembly of the workstation or removal of adjacent panels. Provide for connection of similar or dissimilar heights to include trim pieces to finish the exposed edge. Right angle (90 degree) connections between panels must not interfere with the capability to hang work surfaces and other components on any adjacent panel. Provide, as required, the continuation of electrical and communications wiring within workstations and from workstation to workstation. Filler posts must be level with the top rail.

2.3.6 Glazed Panel Inserts

Provide safety glass glazed panel inserts in accordance with ANSI Z97.1 and ASTM C1048. Acrylic glazing will not be accepted.

2.4 DESK-BASED SYSTEM

Supply accessories and appurtenances for a completely finished desk-based assembly within the system. Provide a desk-based system that is free-standing, independent of panel system support and capable of structurally supporting work surfaces, shelves, and other components in the configurations shown on the drawings. Provide a variety of nominal widths and depths as indicated on drawings.

2.5 WORK SURFACES

2.5.1 Construction

Construct work surfaces to prevent warpage. Fully support work surfaces from the panels or support jointly by the panels and supplemental legs, pedestals, or furniture end panels. Use supplemental end supports only under work surfaces when the work station configuration does not permit full support by the panels. Use metal support brackets to support work surfaces from the panels, provide metal-to-metal fitting to the vertical uprights of the panels, vertically adjustable, to lock the work surfaces in place without panel modifications. Abutting work surfaces must line up closely and be at equal heights when used in side-by-side configurations in order to provide a continuous and level work surface. Provide pre-drilled holes to accommodate storage components, pedestals and additional supports in work surfaces, or drill holes at the job site to accommodate these items. Provide work surfaces in sizes and configurations shown on the drawings. Provide work surfaces in nominal depths of 24 inches, and 30 inches, plus or minus 2 inches, nominal lengths from 24 to 72 inches, and a nominal thickness from 1 to 1-3/4 inches. Provide height adjustable work surfaces from 25 to 52 inches above the finished floor with an electrical control. Provide work surfaces as shown on the drawings and include hardware necessary to provide firm and rigid support. Work surfaces must have 100 percent off-modular capability with no defacement of any element caused by components when used in an off-modular application.

2.5.2 Finishes

Provide work surfaces with a finished top surface of high pressure plastic laminate and a smoothly finished underside. The work surface must not be damaged by ordinary household solvents, acids, alcohols, or salt solutions. Provide metal support brackets that match the color and finish of trim. Provide PVC edges.

2.6 PEDESTALS

Provide drawer configurations and pedestal height as shown on the drawings. Provide the deepest possible pedestal for each work surface size specified. Free standing mobile pedestals to include an attached upholstered seat cushion, and casters. Mobile pedestals must be load bearing and equipped with counterbalance as standard. Provide appropriate height of mobile pedestal so it can be stored under a standard height worksurface.

2.6.1 Construction

Provide pedestals and drawers of steel construction. Securely attach drawer faces to the drawer front.

2.6.2 Finishes

Provide a factory baked enamel finish or powder coated for steel surfaces. Provide steel drawer fronts.

2.6.3 Drawer Requirements

Pedestals must be field interchangeable from left to right, and right to left, and must retain the pedestal locking system capability. Design pedestals to protect wires from being damaged by drawer operation. Provide pedestals that are support work surfaces, or mobile. Drawers must stay securely closed when in the closed position and provide each drawer with a safety catch to prevent accidental removal when fully open. File drawers to be provided with full extension ball bearing drawer slides or rack and pinion suspension. File drawers to be provided with hanging folder frames or rails and capable of hanging side-to-side or front-to-back. Provide dividers with vertical files. Provide box drawers with pencil trays.

2.7 STORAGE

Provide storage units in the sizes and configurations shown on the drawings. Provide task lights under overhead cabinets. Depth to accommodate a standard three ring binder. Panel attached storage is required to have 100 percent off-modular compatibility with no defacement of any element caused by components when used in an off-modular application.

2.7.1 Overhead Cabinet Construction

Provide metal construction overhead cabinets. Provide doors with a suspension system. Provide overhead cabinet door that retracts over the top of the cabinet.

2.7.2 Lateral File Construction

Provide units and file fronts, top and end panels of steel construction. File drawers to be provided with full extension ball bearing drawer slides or rack and pinion suspension. File drawers to be provided with hanging folder frames or rails and capable of hanging side-to-side or front-to-back.

2.7.3 Personal Storage Tower Construction

Provide personal storage tower and components of steel construction. Height of the unit to be the same height as the surrounding panels. The personal storage tower will include one full height wardrobe unit with coat rod, two file drawers, bookcase with two adjustable shelves, and hinged lockable doors.

2.7.4 Finish

Provide a factory baked enamel or epoxy powder coat finish for shelves, dividers and top dust cover. Provide either a factory baked enamel, epoxy powder coat or laminate finish for shelf supporting end panels. Shelf bottom is required to match end panel color. Provide metal doors with an exterior finish of factory baked enamel and an interior finish of factory baked enamel or epoxy powder coat. Provide a factory baked enamel finish or epoxy powder coat on metal drawers.

2.8 ACCESSORIES

2.8.1 Coat Hook

Provide one mounted coat hook per workstation.

2.8.2 CPU Holder

Provide a mounting to support the computer hard drive. Desk top and floor locations are not acceptable.

2.8.3 Signage

Provide panel mounted signage composed, at a minimum, of aluminum frame, back panel, clear plastic cover, and hanging device. Provide signage approximately 3 by 8 inches and capable of receiving a replaceable paper insert. Provide software for creating text in PC computers for owner production of replacement paper inserts after project completion.

2.9 MISCELLANEOUS HARDWARE

Provide brackets, supports, hangers, clips, panel supported legs, connectors, adjustable feet, cover plates, stabilizers, and other miscellaneous hardware that contribute to a complete and operable furniture system.

2.10 LOCKS AND KEYING

Provide overhead cabinets, personal storage towers, pedestals and lateral files with keyed locks, unless otherwise noted. Provide field changeable lock cylinders with a minimum of 100 different key options. Key each workstation individually, and key locks alike within a workstation. Provide lockable drawers within a pedestal either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal. Key alike
central file and storage units which are grouped together but are not a part of a workstation unless otherwise specified. Provide two keys for each lock or two keys per workstation when keyed alike, and provide three master keys per area as indicated. Number keys and lock cylinders for ease of replacement. Clearly label locks with a key number, except for those manufacturers who have removable format locks.

2.11 POWER AND COMMUNICATIONS

Provide both powered and nonpowered panels with base raceways capable of distributing power circuits, and communication cables. Provide nonpowered bases that are capable of easy field conversion to powered base without requiring the panel to be dismantled or removed from the workstation. Provide panels able to support lay-in cabling and having a large capacity for power and data. Provide ample space for storing excess wires and fiber optic cables in the interior of the spine wall frame. Provide easy access to power and data systems in the spine wall without having to move return panels or components. Provide the ability for the spine wall system to supply power to a wall-attached panel system and/or an adjacent desk system. A termination center or utility closet may be utilized in the wall or at the end of a panel run. Provide copper wiring harnesses or electrified bus for the system and meet the requirements of UL 1286 and NFPA 70, Article 605. Provide conductors with 20 amp 90 degree C, #12 AWG wires (unless indicated otherwise) or the equivalent in the bus configuration. A single circuit must not serve more than four (4) cubicles or workstations under any circumstances. The label or listing of Underwriter's Laboratories, Inc. will be accepted as evidence that the material or equipment conforms to the applicable standards of that agency. In lieu of this label or listing, submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures of UL and that the materials and equipment comply with contract requirements. Electrical work not addressed in this section must conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.11.1 Panel Raceways

Provide panels that have hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. Place raceways in locations such as the base, beltline, and below and above the beltline. The raceway must not extend past either panel face by more than 1/2 inch. Provide metal or plastic covers which attach securely to the raceway as required and match the finish and color of the panel trim. Provide a minimum of 2 knockouts (doors) per side for power receptacles and communications jacks as indicated in raceways in full size over 24 inches powered panels. Provide other raceways that are flush with panel face.

2.11.2 Power Distribution

Provide power distribution as indicated on the drawings. Provide an internal power and communications raceway and the capability of disconnecting and connecting external circuits to the electrified raceway in the panel. Capacity for at least twenty 4-pair category 6 cables is required for the communications receiving raceway. Power and communications wiring may share a common wireway if a metal divider is included to ensure electrical isolation. Provide doors or access openings for entry of communications cable. Provide the electrified power raceway for the 10-wire configuration indicated. Unless otherwise indicated, allocate conductors of the 10-wire system as follows (4-4-2 independent neutrals, 2+2): The three-phase system will have two equipment grounds, four neutral, and four phase conductors; one neutral will be dedicated to each phase conductor; one equipment ground conductor will be shared by two circuits, and no ground conductor will be on the same circuit as two phase conductors from the same phase. No shared neutrals allowed.

2.11.2.1 Receptacles

Provide power receptacles in the powered panels. Place devices at the locations indicated on the plans connected to the designated circuits. Electrical power receptacles and communications jacks should have the ability to be hung at multiple vertical increments throughout the frame via power harnesses. Unless otherwise indicated, receptacles must be 20 amp (NEMA 5-20R) commercial grade conforming to NEMA WD 1 and NEMA WD 6. Provide 10 percent spare devices of each type shown on these plans if receptacles are not interchangeable or will not permit field adjustment of phase and circuit selection. All receptacles are required to be of the duplex configuration; unless otherwise indicated, special use receptacles are required to be of the simplex configuration with the blade/pin arrangement identified on the plans. Coordinate the color of receptacle bodies with the color of the panel trim. Isolated ground receptacles must have distinct markings. Furniture receptacles whose building power supply circuit is controlled by an energy management system, timer, or some other automatic means or are provided with local automatic control, will be identified using the standard symbol shown in NFPA 70 Figure 406.3(E); each outlet on a multi-outlet receptacle shall be identified individually. Provide field applied identification that is permanent; stick-on or non-setting adhesives are not acceptable. Provide 5 percent spare devices for each configuration and type of receptacle. Provide a minimum of 5 receptacle removal tools for systems that require special tools for proper receptacle removal.

2.11.2.2 Power Cabling Variations

The paragraph Power Distribution has identified specific cabling configurations. Since universal conventions have not been established, variant configurations available from various manufacturers will be considered. Alternates shall allow the same circuiting, device connections, neutral and ground separation, and upstream feeder connections as shown on the plans. See paragraph ALTERNATE DESIGN. An example of an acceptable variation includes the use of a manufacturer's configuration which allocates individual conductors differently, but which has the same quantity of conductors and allows devices to be physically connected in the field as shown on the plans. It is not necessary that the manufacturer's labeling codes or terminology match the designations used on project plans or in the specifications; however, neutrals and grounds shall have insulation color coded per standard practice or be provided with tags, colored tape, colored ribbons or similar identification. (The reference to "dedicated" conductors in this specification pertains to circuit connections upstream and load connections downstream of panels; it is not necessary that manufacturer's designations correspond.)

2.11.3 Electrical Connections

2.11.3.1 Internal Connections

Utilize straight or flexible plug/receptacle connector assemblies for internal panel-to-panel power connections and provide the powered configurations shown on the drawings.

2.11.3.2 Connections to Building Services

Supply external power and communications services to the panels via hard

wired top entry junction box assemblies. Extend wiring from building services to junction box assemblies in metal conduit or tubing. Provide wiring from junction boxes that is flexible liquid-tight conduit 6 foot maximum or in metal conduit or tubing. Do not use cord and plug assemblies for any portion of external links. Top entry junction box assemblies are required to extend the power and communications wiring into service entry poles attached to the electrified panels. External wiring must conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.11.4 Wire Management

Provide wire management capability at all workstations and accommodate all cable types specified, including the applicable manufacturer required bending radius at corners. Design raceways and interfaces to the raceways to accommodate the bend radius as shown in TIA-569 for Category 6A and fiber optic cables communication wiring. Copper and fiber cabling shall meet the requirements of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. The capability may be accomplished by cable access cutouts (1 minimum per work surface), covered wire management troughs in vertical end panels, horizontal wiring troughs, internal midpanel (beltline) raceways, or rear gaps (between the back edge of the work surface and the facing support panel). Provide grommet kits or another suitable finish arrangement for all cable cutouts. Provide accessories for an externally mounted vertical and horizontal wire management and concealment system as recommended by the manufacturer. Supply horizontal wire managers for mounting under all work surfaces. Attach the wire managers either to the underside of the work surface or to the vertical panel without damaging the face. Exposed or loose wiring will not be acceptable. Wire managers must be prefinished and secure, conceal, and accommodate outlet cords as well as electrical and communications wiring. Wire channels are required to match color of panel trim, attach by means of clip-on attachment, and conceal wires routed vertically. Separate power wiring from communication wiring by use of separate raceways or by placement of channels in joint use troughs or wireways. Separate "house power" and "technical power" per WPAFB IFS and TEMPEST requirements.

2.11.5 Circuit Layout

Provide the circuit layout for workstations on the drawings. Connect devices to the designated circuits in the neutral, ground, and automatic control configurations indicated. Connections must be made to the building electrical distribution system as shown on the contract drawings and in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.11.6 Service Entry Poles

Provide service poles, as indicated on the contract drawings, and capable of minimally accommodating the 10-wire power configuration and the equivalent of twenty 4-pair category 6 cables. Poles must have metal barriers or channels to separate power and communications wiring. Pole dimensions can be equal to maximum panel thickness. Designated poles are required to have the capability of being opened along the vertical access to permit the lay-in of wiring. Provide each pole with a wiring interface, an end cap and a ceiling trim plate which extends a minimum of 1-1/2 inches from all sides of the pole. Include a junction box either as part of the pole assembly or in a field installed configuration with poles for power service. Service poles must be securely attached to the panels and installed plumb. Provide wiring and interface components as required to connect the building power supply

to power poles. Separate "house power" and "technical power" per WPAFB IFS and TEMPEST requirements.

2.11.7 Task Lighting

Provide task lights with light emitting diode (LED) technology to include a built-in reflector and shielding device that prevents direct glare into an occupant's eyes when they are in a typical working position. Provide task light size and placement on the contract drawings. It is required that lights be a standard component of the manufacturer's workstation products, and the ends of the task light length can not extend beyond the edges of the overhead cabinet. Enclose task light power cords within vertical wire cover or clips. Luminaires shall be UL approved for use in the configurations indicated on the drawings.Provide task lighting that is Energy Star labeled. Provide data identifying Energy Star label for task lighting.

2.11.7.1 Luminaire Configuration

Provide luminaires and lamps as specified in Section 26 51 00 INTERIOR LIGHTING and modified herein. For undershelf or undercabinet lighting, provide luminaires that are light emitting diode (LED) type and have prismatic lenses, baffles, or other shielding device configured to minimize glare by shielding the lamp from view of the seated user. For LED-type task lighting, power consumption shall not exceed 8 watts per foot. Correlated Color Temperature (CCT) of task lighting shall match the CCT of the ambient room lighting. Provide an easily accessible on-off switch and one ballast or driver per luminaire. A variable intensity control is acceptable if the low setting is equivalent to "off" with zero energy consumption. Multiple level switching is also acceptable. For LED type technology, ganged luminaires or shared drivers are permitted for up to 4 continuous feet in length. A single driver designed for use with an individual LED housing of greater than 4 feet in length is allowed.

2.11.7.2 Wiring

Provide each luminaire with a 6 foot minimum, factory installed, heavy duty electrical cordset with a grounded plug for luminaries that are mounted on the same wall as the receptacle. Provide luminaires mounted on non-powered wall with a 9 foot minimum, factory installed heavy duty electrical cordset with a grounded plug. Direct or hard wire connections are not acceptable. Unless otherwise indicated, conceal cord. Built-in cord concealment is required within panels or utilize field installed, manufacturer approved accessories. Cords may be extended through dedicated channels located at any point within panels or may be placed in vertical slots or in the space between panels if held in place by retainers and concealed by a cover plate. Vertical wire managers are required to be prefinished and cut to size and shall extend from the task light level down to the top of the work surface below the task light. Attach each manager to a panel vertical edge or connector strip without damage to the surfaces.

2.11.7.3 Control Device

Provide task lighting with a manual ON/OFF switch.

2.11.8 Communications

Communications wiring will be extended to, and installed in, the

electrified panels as shown on the plans. Install communications jacks at designated locations. Communications work may be performed in conjunction with the installation of workstations or may be separately executed at the Contractor's option; however, equipment, materials, and installation must conform to the requirements of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM, and properly coordinate all interfaces.

2.11.9 Special Systems

Provide management for secure (technical) and nonsecure (house) power, computer and telecommunications cabling through designated raceway systems. Separate secure distribution from nonsecure distribution by running secure lines along top located raceway and nonsecure along the bottom of the workstation panel.

PART 3 EXECUTION

3.1 INSTALLATION

Install the workstations using certified installers in accordance with manufacturer's recommended installation instructions. A licensed electrician is required to hardwire the workstations. Install workstation components level, plumb, square, and with proper alignment with adjoining furniture. Securely interconnect and attach components to the building where required. Provide three sets of special tools and equipment necessary for the relocation of panels and other components. Verify that equipment is properly installed, connected, and adjusted.

3.2 CLEANING

Provide cleanup as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Upon completion of installation, clean and polish all products and leave the area in a clean and neat condition. Any defects in material and installation are required to be repaired, and damaged products that cannot be satisfactorily repaired are required to be replaced. Submit three sets of Maintenance Manuals describing proper cleaning and minor repair procedures.

-- End of Section --

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SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2016) 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	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A135/A135M	(2009; R2014) 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/

INTELLIGENCE COMMUNITY STANDARD (ICS)

ICS 705-1	(2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities

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 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

UNDERWRITERS LABORATORIES (UL)

UL 199	(2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service
UL Fire Prot Dir	(updated online) Fire Protection Equipment Directory

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 2, 2018) Fire Protection Engineering for Facilities

1.2 SYSTEM DESCRIPTION

Provide modifications to the 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 and UFC 3-600-01. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

1.2.1 Hydraulic Design

1.2.1.1 Basis for Calculations

A waterflow test was performed on 7 May 2015 and resulted in a static pressure of 60 psi with a residual pressure of 55 psi while flowing 1,061 gpm. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on flow test noted in this paragraph, unless approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for 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.

g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

1.2.1.3 Design Criteria

Hydraulically design the system as indicated on the drawings. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior hose streams of 250 gpm to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

1.2.2 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the area noted on the contract drawings. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13.

1.2.3 Qualified Fire Protection Engineer (QFPE)

An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES)

and has relevant fire protection engineering experience. Services of the QFPE must include:

a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.

b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting all outstanding comments.

c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).

d. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.

e. Signing applicable certificates under SD-07.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously. SD-02, SD-03, SD-05, and SD-06 submittals shall also be sent to Wright Patterson AFB BCE for review.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE must be returned disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE); G

Sprinkler System Designer; G

Sprinkler System Installer; G

SD-02 Shop Drawings

Shop Drawing; G

SD-03 Product Data

Pipe; G

Fittings; G

Valves, including gate, check, butterfly, and globe; G

Sprinklers ; G

Pipe Hangers and Supports ; G

Nameplates; 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

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions; G

Spare Parts Data; G

SD-11 Closeout Submittals

As-built drawings

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing work on site, the Prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved Without Review.

1.4.1.1 Shop Drawing

Two 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 ANSI D. 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, 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

Two copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

1.4.1.3 Hydraulic Calculations

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Calculations must include isometric diagram indicating hydraulic nodes and pipe segments.

1.4.1.4 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide six manuals and one pdf version on electronic media. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, troubleshooting guide, and recommended service organization

(including address and telephone number) for each item of equipment.

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

1.4.2 Qualifications

1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a minimum 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 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than 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 minimum Schedule 40.

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 Flexible Sprinkler Hose

The use of flexible hose is not permitted.

2.2.3 Pipe Hangers and Supports

Provide galvanized pipe hangers and supports in accordance with NFPA 13.

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.

2.3.1 Pendent Sprinkler

Pendent sprinkler must match the existing pendant sprinklers in the facility. Assembly must include an integral escutcheon.

2.3.2 Upright Sprinkler

Upright sprinkler must match the existing upright sprinklers in the facility.

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.

2.4.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 3/4-inch and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

2.4.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.4.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located within 7 feet of the floor.

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 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 ensure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) that are concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.

c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the Contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash which may have accumulated during the day as a result of work by the Contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the Contractor, which will affect the condition and safety of streets, walks, utilities, and property.

3.3 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must

fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.3.1 Protection of Piping Against Earthquake Damage

Seismic restraint is not required.

3.3.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

3.3.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping must be inspected, hydrostatically tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

3.3.4 Pendent Sprinklers

a. Drop nipples to pendent sprinklers must consist of minimum 1-inch pipe with a reducing coupling into which the sprinkler must be threaded.

b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.

c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.

d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (plus or minus 2 inches).

3.3.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

3.3.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for

each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.3.7 Reducers

Reductions in pipe sizes must be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings cannot be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.3.8 Pipe Penetrations

a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.

b. Where pipes and sleeves penetrate fire barriers, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.

c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

d. All penetrations through the boundary of rooms/areas identified as secure space area must meet ICS 705-1.

3.3.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

3.4 PAINTING

Color code mark piping as specified in Section 09 90 00 PAINTS AND COATINGS.

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 Sprinkler Technician, and the representative of the installing company, and reviewed by the QFPE 60 days prior to performing system tests. Detailed test procedures must list all components of the installed system. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13). The test procedures and accompanying

test data forms must be used for the pre-Government testing and the Government final testing.

a. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.5.2 Pre-Government Testing

3.5.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13. The Contractor and QFPE must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

a. NFPA 13 Aboveground Material and Test Certificate.

3.5.2.2 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 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. Government final testing will not be performed until after the connections to the building fire alarm system have been completed and tested to confirm communications are fully functional. Submit request for test at least 15 calendar days prior to the requested test date.

3.5.3 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. The Contractor's Qualified Fire Protection Engineer (QFPE).

c. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the Contracting Officer and Qualified Fire Protection Engineer (QFPE). At this time, all required

tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.6 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 aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13.

3.6.1 Aboveground Piping

3.6.1.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

3.7 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.

b. Provide operating and maintenance (O&M) instructions.

3.8 ONSITE TRAINING

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of 4 hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS
08/10

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 A13.1	(2015) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus

1.2 SUSTAINABILITY REQUIREMENTS

Materials in this technical specification may contribute towards contract compliance with sustainability requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment Labels; G

Pipe Labels; G

Duct Labels; G

1.4 RELATED REQUIREMENTS

This Section applies to all Sections of DIVISION 23, HEATING, VENTILATING, AND AIR CONDITIONING of this Project Specification, unless specified otherwise in the individual Section.

1.5 QUALITY ASSURANCE

1.5.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design, and workmanship. Standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use must include applications of

equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

1.5.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.5.3 Service Support

The equipment items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the Contract.

1.5.4 Manufacturer's Nameplate

For each item of equipment, provide a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.5.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.5.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the Contract Documents, advisory provisions must be considered mandatory, the word "should" is interpreted as "must." Reference to the "code official" must be interpreted to mean the "Contracting Officer." For leased facilities, references to the "Owner" must be interpreted to mean the "lessor." References to the "permit holder" must be interpreted to mean the "Contractor."

1.5.5.2 Administrative Interpretations

For ICC Codes referenced in the Contract Documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this Contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this Project. References in the ICC Codes to sections of Chapter 1, must be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.6 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.7 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects, and contactors with their respective pieces of equipment. Motors, controllers, disconnects, and contactors must conform to and have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and must have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work must be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment must be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other Sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work.

Instruction must be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished must be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the Contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.9 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this Section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Energy Efficient Equipment for Motors

Provide documentation that the motors meet energy efficiency requirements as outlined in this Section.

2.2 EQUIPMENT LABELS

a. Metal Labels for Equipment:

(1) Material and Thickness: Brass, 0.032 inch, stainless steel, 0.025 inch or aluminum, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

(2) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.

(3) Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

(4) Fasteners: Stainless-steel rivets or self-tapping screws.

(5) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

b. Plastic Labels for Equipment:

(1) Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

(2) Letter Color: Black.

(3) Background Color: White.

(4) Maximum Temperature: Able to withstand temperatures up to 160 degrees F.

(5) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.

(6) Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

(7) Fasteners: Stainless-steel rivets or self-tapping screws.

(8) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

c. Label Content: Include equipment's drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

d. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 by 11-inch bond paper. Tabulate equipment identification number and identify drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment Schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

b. Letter Color: Black, unless otherwise indicated.

c. Background Color: Yellow, unless otherwise indicated.

d. Maximum Temperature: Able to withstand temperatures up to 160 degrees F.

e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.

f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

g. Fasteners: Stainless-steel rivets or self-tapping screws.

h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

i. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS AND DUCT LABELS

a. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

b. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

c. Self-Adhesive Pipe and Duct Labels: Printed plastic with contact-type, permanent-adhesive backing.

d. Pipe and Duct Label Contents: Include identification of service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

(1) Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

(2) Lettering Size: At least 1-1/2 inches high.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with ASTM B117, and for that test the acceptance criteria must be as follows: Immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system must be designed for the temperature service.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F must be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat must be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F must receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F must receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

3.2 IDENTIFICATION AND LABELING

3.2.1 Preparation

Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents,

and incompatible primers, paints, and encapsulants.

3.2.2 Equipment Label Installation

a. Install or permanently fasten labels on each major item of mechanical equipment.

b. Locate equipment labels where accessible and visible.

3.2.3 Pipe Label Installation

a. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

(1) Identification Paint: Use for contrasting background.

(2) Stencil Paint: Use for pipe marking.

b. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

(1) Near each valve and control device.

(2) Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

(3) Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

(4) At access doors, manholes, and similar access points that permit view of concealed piping.

(5) Near major equipment items and other points of origination and termination.

(6) Spaced at maximum intervals of 75 feet along each run.

(7) On piping above removable acoustical ceilings.

c. Pipe Label Color Schedule:

(1) Chilled-Water Piping:

(a) Background Color: Safety Green.

(b) Letter Color: White.

(c) Legend: CHWS (for Supply), CHWR (for Return).

(2) Heating Water Piping:

(a) Background Color: Safety Yellow.

(b) Letter Color: Black.

(c) Legend: HWS (for supply), HWR (for return).

(3) Wet Pipe Sprinkler Piping:

(a) Background Color: Safety Red.

(b) Letter Color: White.

(c) Legend: Sprinkler Piping.

(4) Cooling Coil Condensate Piping:

(a) Background Color: Safety Green.

(b) Letter Color: White.

(c) Legend: COND.

3.3 DUCT LABEL INSTALLATION

a. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

(1) Blue: For cold-air supply ducts.

(2) Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

(3) ASME A13.1 Colors and Designs: For hazardous material exhaust.

b. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

c. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

-- End of Section --

SECTION 23 05 48.00 40

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
08/15

PART 1 GENERAL

Section 23 30 00 HVAC AIR DISTRIBUTION applies to work specified in this section to the extent applicable.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S2.71	(1983; R 2006) Guide to the Evaluation of Human Exposure to Vibration in Buildings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE HVAC APP IP HDBK	(2016) HVAC Applications Handbook, I-P Edition

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A572/A572M	(2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A603	(2019) Standard Specification for Zinc-Coated Steel Structural Wire Rope
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS	(2015) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2016, Change 1, June 2016) Seismic Design for Buildings
UFC 4-010-01	(2018) DoD Minimum Antiterrorism Standards for Buildings

1.2 ADMINISTRATIVE REQUIREMENTS

Submit equipment and performance data for vibration isolator systems including equipment base design; inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

Ensure the data includes information on the following:

a. Mountings.

b. Bases.

c. Isolators.

Submit installation drawings for vibration isolator systems including equipment and performance requirements.

Indicate within outline drawings for vibration isolator systems, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

Outline Drawings

SD-03 Product Data

Equipment and Performance Data; G

Isolators; G RO

SD-05 Design Data

Bracing For Force Protection; G

1.4 QUALITY CONTROL

Ensure all vibration-control apparatus is the product of a single manufacturing source, where possible. Human exposure levels should be considered using ASA S2.71 and NEBB PROCEDURAL STANDARDS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Scheduled isolation mounting is in inches and is a minimum static deflection.

Spans referred to in paragraph EQUIPMENT, means longest bay dimension.

Determine exact mounting sizes and number of isolators by the isolator manufacturer based on equipment that will be installed. Check equipment revolutions per minute (rpm) and spring deflections to verify that resonance cannot occur.

2.1.1 Design Requirements

Design for vibration isolation using NEBB PROCEDURAL STANDARDS or ASHRAE HVAC APP IP HDBK, Chapter 48, as applicable to the following sections.

2.1.1.1 Mountings

Provide the following mountings:

Type A: Composite pad, with 0.25-inch thick elastomer top and bottom layers, molded to contain a pattern with nonslip characteristics in all horizontal directions. Elastomer loading is not to exceed 40 pounds per square inch (psi). Ensure minimum overall thickness is 1 inch. Maximum deflections up to 0.25 inch are allowed.

2.1.1.2 Bases

Provide the following bases:

Type U: Unit isolators without rails, structural-steel bases, or inertia blocks.

Type R: Rails, connected mill-rolled structural steel, of sufficient dimension to preclude deflection at midpoint of unsupported span in excess of 1/1,440th of the span between isolators, power transmission, component misalignment, and any overhung weight. Where Type R bases are specified and the equipment proposed requires additional base support, use a Type S base.

Type S: Structural-steel bases common to a supported assembly, made from welded-joint mill-rolled structural steel with closed-perimeter configuration, isolators attached to outrigger supports.

Ensure height of steel members is sufficient to provide stiffness required to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Ensure height of steel member does not result in member deflection at midpoint of unsupported span of more than 1/1,440th of the span between

isolators. Minimum height is 5 inches.

2.2 EQUIPMENT

Vibration isolation design per NEBB PROCEDURAL STANDARDS or ASHRAE HVAC APP IP HDBK, Chapter 37.

2.2.1 Low-Pressure AHU Locations

Vibration-isolation provisions apply to floor-mounted Air Moving and Conditioning Association Class A packaged central-station units.

TYPE EQUIPMENT	BASEMENT BELOW-GRADE PROVISIONS*	ON/ABOVE GRADE 20-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 30-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 40-FOOT FLOOR-SPAN PROVISIONS*
Through 5 hp	B-U-0.35	C-U-1.0	C-U-1.0	C-U-1.0
7-1/2 hp and over 250 to 500 rpm	B-U-0.35	C-U-1.75	C-U-1.75	C-U-1.75
500 rpm	B-U-0.35	C-U-1.0	C-U-1.5	
*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES				

2.2.2 Pipe and Duct Vibration Isolation

Type G: Provide isolators with in-series contained steel springs and preformed fibrous-glass or chloroprene-elastomer elements for connecting to building-structure attachments. Load devices by supported system during operating conditions to produce a minimum spring and elastomer static deflection of 1 inch and 3/8 inch, respectively.

2.3 MATERIALS

Ensure rubber is natural rubber and elastomer is chloroprene. Shore A durometer measurement of both materials and range between 40 and 60.

Inorganic materials such as precompressed, high-density, fibrous glass encased in a resilient moisture-impervious membrane may be used in lieu of specified natural rubber and elastomers. Where this substitution is made, ensure specified deflections are modified by the manufacturing source to accommodate physical characteristics of inorganic materials and to provide equal or better vibration isolation.

Ensure weather-exposed metal vibration-isolator parts are corrosion protected. Chloroprene coat springs.

2.4 BRACING FOR FORCE PROTECTION

Design the bracing in accordance with UFC 3-310-04, UFC 4-010-01, and additional data furnished by the Contracting Officer. Provide sufficient braces for equipment to resist reactions for force protection as indicated

in this paragraph. Submit details of equipment bracing for acceptance. The design for force protection for all overhead equipment weighing 31 pounds or more shall be mounted to resist forces of 0.5 times the component weight in any horizontal direction and 1.5 times the component weight in the downward direction.

The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 1.5 times the operating weight of the equipment at the vertical center of gravity of the equipment in the downward direction and 0.5 times the operating weight of the equipment at the horizontal center of gravity of the equipment in any direction:

a. Unit Heaters.

b. VAV Boxes.

2.5 SWAY BRACING MATERIALS

Material used for members listed in this Section shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A36/A36M. If the Contractor does the design, both ASTM A36/A36M and ASTM A572/A572M, Grade 503 will be allowed.

b. Wire rope, ASTM A603.

c. Tubes, ASTM A500/A500M, Grade B.

d. Pipes, ASTM A53/A53M, Type S, Grade B.

e. Light gauge angles, less than 1/4-inch thickness, ASTM A653/A653M.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Ensure rails, structural steel bases, are raised not less than 1 inch above the floor and are level when equipment supported is under operating load.

Ensure vibration-isolation installation and deflection testing after equipment start-up is directed by a competent representative of the manufacturer.

-- End of Section --

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SECTION 23 05 93.00 06

TESTING, ADJUSTING, AND BALANCING OF HVAC
06/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(2002, 6th ed) National Standards for Total System Balance

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS	(2015) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1780	(2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G

TAB Schematic Drawings and Report Forms, three copies, no later than 21 days prior to the start of TAB field measurements.

SD-03 Product Data

TAB Related HVAC Submittals

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

TAB Procedures; G

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration

List of each instrument to be used during TAB, stating calibration requirements required or recommended by both the TAB Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

Systems Readiness Check

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; G

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; G

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-06 Test Reports

Design Review Report; G

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check; G

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Report; G

Completed TAB Reports, three copies, no later that 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Verification Report; G

Completed TAB Verification Report, three copies, no later that 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-07 Certificates

Ductwork Leak Testing

A written statement signed by the TAB Specialist certifying that the TAB Specialist witnessed the Ductwork Leak Testing, it was successfully completed, and that there are no known deficiencies related to the ductwork installation that will prevent TAB from producing satisfactory results.

TAB Firm; G

Certification of the proposed TAB Firm's qualifications by either AABC, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC, NEBB or TABB against the proposed TAB Firm shall be described in detail.

TAB Specialist; G

Certification of the proposed TAB Specialist's qualifications by either AABC, NEBB, or TABB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC, NEBB, or TABB against the proposed TAB Specialist shall be described in detail.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard Procedures	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.	SMACNA's
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness	Construction Phase Inspection	Field Readiness Check & Preliminary	Field

SIMILAR TERMS

Readiness Check Procedures	Field Procedures.	Check & Prelim. Field

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.5 QUALIFICATIONS

1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems, building systems commissioning and the measuring of sound and vibration in environmental systems. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this section and in other related sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of the mechanical subcontractor, and shall report to and be paid by the prime Contractor.

1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC,an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this section and in other related sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed under the direct guidance of the TAB Specialist. The TAB specialist is required to be onsite on a daily basis to direct TAB efforts. The TAB Specialist shall participate in the commissioning process specified in Section 01 46 00.00 06 TOTAL BUILDING COMMISSIONING.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and identify in a Design Review Report any deficiencies that would prevent the effective and accurate TAB of the system. In the Design Review Report, the TAB Specialist shall individually list each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a letter certifying that submitted equipment will allow proper testing, adjusting, and balancing of the HVAC systems. The letter shall be signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify

all testing points and cross reference these points to the report forms and procedures.

3.4 DUCTWORK LEAK TESTING

The TAB Specialist shall lead and oversee the Ductwork Leak Testing specified in Section 23 30 00 HVAC AIR DISTRIBUTION and approve the results as specified in Paragraph TAB RELATED HVAC SUBMITTALS.

3.5 TESTING, ADJUSTING, AND BALANCING

3.5.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

3.5.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness Check.

3.5.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall prepare a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation and the Contractor shall immediately notify the Contracting Officer.

3.5.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements

selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. The TAB Specialist shall update the original TAB report to reflect any changes or differences noted in the TAB verification report and submit the updated TAB report. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

The Contractor shall be responsible for all necessary insulation repair following completion of TAB Verification.

3.5.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Marking shall be visible following completion or repair of insulation.

3.5.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

-- End of Section --

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SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS
02/13

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. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - SI	(2019; Errata 1-4 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-AB 2021; Errata 5-7 2021; Interpretation 1-4 2020; Interpretation 5-8 2021) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A240/A240M	(2020a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A580/A580M	(2018) Standard Specification for Stainless Steel Wire
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C195	(2007; R 2013) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C450	(2008) Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
ASTM C533	(2017) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534/C534M	(2020a) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular

	Form
ASTM C547	(2019) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2021a) Standard Specification for Cellular Glass Thermal Insulation
ASTM C647	(2008; R 2013) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C795	(2008; R 2018) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(2020) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010; R 2015) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	(2021) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1710	(2011) Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form
ASTM D2863	(2019) Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM D5590	(2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
ASTM E84	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2021) Standard Test Methods for Gravimetric Determination ofWater Vapor Transmission Rate of Materials
ASTM E2231	(2021) Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

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

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(8th Ed) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2021) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation
MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-PRF-19565	(1988; Rev C) Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor-Barrier

UNDERWRITERS LABORATORIES (UL)

UL 94	(2013; Reprint Mar 2022) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUSTAINABILITY REQUIREMENTS

Materials in this technical specification may contribute towards contract compliance with sustainability requirements.

1.3 SYSTEM DESCRIPTION

1.3.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-02 Shop Drawings

MICA Plates

Pipe Insulation Systems and Associated Accessories

Duct Insulation Systems and Associated Accessories

Equipment Insulation Systems and Associated Accessories

Recycled content for insulation materials

SD-03 Product Data

Pipe Insulation Systems; G

Duct Insulation Systems; G

Equipment Insulation Systems; G

SD-04 Samples

Thermal Insulation

Display Samples; G RO

SD-07 Certificates

Indoor air quality for adhesives

SD-08 Manufacturer's Instructions

Pipe Insulation Systems

Duct Insulation Systems

Equipment Insulation Systems

1.5 CERTIFICATIONS

1.5.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.6 QUALITY ASSURANCE

1.6.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.7 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet and in conjunction with the MICA plates booklet (SD-02). Annotate the product data to indicate which MICA plate is applicable.

2.1.1 Insulation System

Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems. Provide CFC and HCFC free insulation.

2.1.2 Surface Burning Characteristics

Unless otherwise specified, insulation must have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Test insulation in the same density and installed thickness as the material to be used in the actual construction. Prepare and mount test specimens according to ASTM E2231.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - SI. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free. Provide product recognized under UL 94 (if containing plastic) and listed in FM APP GUIDE.

2.2.1 Adhesives

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168 (HVAC duct sealants must meet limit requirements of "Other" category within SCAQMD Rule 1168 sealants table). Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or

classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for adhesives.

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. To resist mold/mildew, lagging adhesive shall meet ASTM D5590 with 0 growth rating. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white or red and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

2.2.1.4 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Flexible Elastomeric Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product listed in FM APP GUIDE.

2.2.2 Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

2.2.3 Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

2.2.4 Fittings

Fabricated Fittings are the prefabricated fittings for flexible

elastomeric pipe insulation systems in accordance with ASTM C1710. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor). For satisfactory performance, properly installed protective vapor retarder/barriers and vapor stops shall be used on high relative humidity and below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder interior surface.

2.2.5 Finishing Cement

ASTM C450: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.2.7 Staples

Outward clinching type ASTM A167, Type 304 or 316 stainless steel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive, greater than 3 plies standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive); with 0.0000 permeability when tested in accordance with ASTM E96/E96M, using the water transmission rate test method; heavy duty, white or natural; and UV resistant. Flexible Elastomeric exterior foam with factory applied, UV Jacket made with a cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent Water Vapor Transmission (WVT) rate.

2.2.8.3 Vapor Barrier/Vapor Retarder

Apply the following criteria to determine which system is required.

a. On ducts, piping and equipment operating below 60 degrees F or located outside shall be equipped with a vapor barrier.

b. Ducts, pipes and equipment that are located inside and that always operate above 60 degrees F shall be installed with a vapor retarder where required as stated in paragraph VAPOR RETARDER REQUIRED.

2.2.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require manufacturer or fabricator applied pipe insulation jackets are cellular glass, when all joints are sealed with a vapor barrier mastic, and mineral fiber. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible elastomerics require (in addition to vapor barrier skin) vapor retarder jacketing for high relative humidity and below ambient temperature applications.

2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

ASJ is for use on hot/cold pipes, ducts, or equipment indoors or outdoors if covered by a suitable protective jacket. The product shall meet all physical property and performance requirements of ASTM C1136, Type I, except the burst strength shall be a minimum of 85 psi. ASTM D2863 Limited Oxygen Index (LOI) shall be a minimum of 31.

In addition, neither the outer exposed surface nor the inner-most surface contacting the insulation shall be paper or other moisture-sensitive material. The outer exposed surface shall be white and have an emittance of not less than 0.80. The outer exposed surface shall be paintable.

2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

2.2.9.2.1 Vapor Barrier

The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Permeability shall be less than 0.02 when tested in accordance with ASTM E96/E96M. Products shall meet UL 723 or ASTM E84 flame and smoke requirements and shall be UV resistant.

2.2.9.2.2 Vapor Retarder

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be 0.013 perms or less at 43 mils dry film thickness as determined according to procedure

B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be nonflammable, fire resistant type. To resist mold/mildew, coating shall meet ASTM D5590 with 0 growth rating. Coating shall meet MIL-PRF-19565 Type II (if selected for indoor service) and be Qualified Products Database listed. All other application and service properties shall be in accordance with ASTM C647.

2.2.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork; where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate.

2.2.9.4 Vapor Barrier/Weather Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.10 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.11 Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2.12 Insulation Bands

Insulation bands shall be 1/2-inch wide; 26 gauge stainless steel.

2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum permeance of 0.02 perms based on Procedure B for ASTM E96/E96M, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Conform insulation materials to Table 1 and minimum insulation thickness as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - SI. Limit pipe insulation materials to those listed herein and meeting the following requirements:

2.3.1 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Rock Wool: 75 percent slag of weight.

Fiberglass: 20 percent glass cullet.

Rigid Foam: 9 percent recovered material.

Phenolic Rigid Foam: 9 percent recovered material.

Provide data identifying percentage of recycled content for insulation materials.

2.3.2 Aboveground Cold Pipeline (minus 30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

2.3.2.1 Cellular Glass

ASTM C552, Type II, and Type III. Supply the insulation from the fabricator with (paragraph WHITE VAPOR RETARDER ALL SERVICE JACKET (ASJ)) ASJ vapor retarder and installed with all longitudinal overlaps sealed and all circumferential joints ASJ taped or supply the insulation unfaced from the fabricator and install with all longitudinal and circumferential joints sealed with vapor barrier mastic.

2.3.2.2 Flexible Elastomeric Cellular Insulation

Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive, complying with ASTM C534/C534M, Grade 1, Type I or II. Type I, Grade 1 for tubular materials. Type II, Grade 1, for sheet materials. Type I and II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation, and require an additional exterior vapor retarder covering for high relative humidity and below ambient temperature applications. Provide pipe hanger inserts at all supports (Armacell Armafix or equal).

2.3.3 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

2.3.3.1 Mineral Fiber

ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

2.3.3.2 Calcium Silicate

ASTM C533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.

2.3.3.3 Cellular Glass

ASTM C552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Factory Applied Insulation

Provide factory-applied insulation according to manufacturer's recommendations for insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.4.1.1 Rigid Insulation

Calculate the minimum thickness in accordance with ASHRAE 90.1 - SI.

2.4.1.2 Blanket Insulation

Calculate minimum thickness in accordance with ASHRAE 90.1 - SI.

2.4.2 Acoustical Duct Lining

2.4.2.1 General

For ductwork indicated or specified in Section 23 30 00 HVAC AIR DISTRIBUTION to be acoustically lined, provide external insulation in accordance with this specification section and in addition to the acoustical duct lining. Do not use acoustical lining in place of duct wrap or rigid board insulation (insulation on the exterior of the duct).

2.4.2.2 Duct Liner

Flexible Elastomeric Acoustical and Conformable Duct Liner Materials: Flexible Elastomeric Thermal, Acoustical and Conformable Insulation Compliance with ASTM C534/C534M Grade 1, Type II; and NFPA 90A or NFPA 90B as applicable.

2.4.3 Duct Insulation Jackets

2.4.3.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

2.4.3.2 Metal Jackets

2.4.3.2.1 Aluminum Jackets

ASTM B209, Temper H14, minimum thickness of 27 gauge (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside dimension 8 inches and larger. Provide corrugated surface jackets for jacket outside dimension 8 inches and larger. Provide stainless steel bands, minimum width of 1/2 inch.

2.4.3.2.2 Stainless Steel Jackets

ASTM A167 or ASTM A240/A240M; Type 304, minimum thickness of 33 gauge (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 1/2 inch.

2.4.3.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive), heavy duty white or natural).

2.4.4 Weatherproof Duct Insulation

Provide ASTM C552, cellular glass thermal insulation or ASTM C534/C534M Grade 1, Type II, flexible elastomeric cellular insulation, and weatherproofing as specified in manufacturer's instruction. Multi-ply, Polymeric Blend Laminate Jacketing: Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate. All exterior insulation shall have metal jacket.

2.5 EQUIPMENT INSULATION SYSTEMS

Insulate equipment and accessories as specified in Tables 5 and 6. In outside locations, provide insulation 1/2-inch thicker than specified. Increase the specified insulation thickness for equipment where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface. Submit a booklet containing manufacturer's published installation instructions for the insulation systems in coordination with the submitted MICA Insulation Stds plates booklet. Annotate their installation instructions to indicate which product data and which MICA plate are applicable. The instructions must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. A booklet is also required by paragraphs titled: Pipe Insulation Systems and Duct Insulation Systems.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Display Samples

Submit and display, after approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each

manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the job site. Approved display sample sections shall remain on display at the job site during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

3.1.1.1 Pipe Insulation Display Sections

Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

3.1.1.2 Duct Insulation Display Sections

Display sample sections for rigid and flexible duct insulation used on the job. Use a temporary covering to enclose and protect display sections for duct insulation exposed to weather

3.1.2 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the job site. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Install flexible elastomeric cellular insulation with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Stagger seams when applying multiple layers of insulation. Protect insulation exposed to weather and not shown to have vapor barrier weatherproof jacketing with metal jacketing as recommended by the manufacturer after the adhesive is dry and cured.

3.1.4.1 Adhesive Application

Apply a brush coating of adhesive to both butt ends to be joined and to both slit surfaces to be sealed. Allow the adhesive to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.4.2 Adhesive Safety Precautions

Use natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment That Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

Install pipe insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Sanitary drain lines.

c. Adjacent insulation.

d. ASME stamps.

e. Access plates of fan housings.

f. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

Pipe insulation shall be continuous through the sleeve.

Provide an aluminum jacket or vapor barrier/weatherproofing self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder over the insulation wherever penetrations require sealing.

3.2.1.2.1 Penetrate Interior Walls

The aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

3.2.1.2.2 Penetrating Exterior Walls

Continue the aluminum jacket required for pipe exposed to weather through the sleeve to a point 2 inches beyond the interior surface of the wall.

3.2.1.2.3 Hot Water Pipes Supplying Heated Service

Terminate the insulation on the backside of the finished wall. Protect the insulation termination with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). Extend the coating out onto the insulation 2 inches and seal the end of the insulation. Overlap glass tape seams 1 inch. Caulk the annular space between the pipe and wall penetration with approved fire stop material. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-58. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

3.2.1.3.1 Horizontal Pipes Larger Than 2 Inches at 60 Degrees F and Above

Supported on hangers in accordance with MSS SP-58.

3.2.1.3.2 Horizontal Pipes Larger Than 2 Inches and Below 60 Degrees F

Supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-58. An insulation insert of cellular glass, prefabricated insulation pipe hangers, or perlite above 80 degrees F shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance

with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

3.2.1.3.3 Vertical Pipes

Supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-58 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

3.2.1.3.4 Inserts

Covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, overlap the adjoining pipe jacket 1-1/2 inches, and seal as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation. Type II requires an additional exterior vapor retarder/barrier covering for high relative humidity and below ambient temperature applications.

3.2.1.5 Pipes In High Abuse Areas

In high abuse areas such as janitor closets and traffic areas in equipment rooms, and mechanical rooms, stainless steel, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000

permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.1.6 Pipe Insulation Material and Thickness

Pipe insulation materials must be as listed in Table 1 and must meet or exceed the requirements of ASHRAE 90.1 - SI.

TABLE 1					
Insulation Material for Piping					
Service					
	Material	Specification	Type	Class	VR/VB Req'd
Chilled Water (Supply & Return, Dual Temperature Piping, 40 F nominal)					
	Cellular Glass	ASTM C552	II	2	Yes
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		Yes
Heating Hot Water Supply & Return (Max 250 F)					
	Mineral Fiber	ASTM C547	I	1	No
	Calcium Silicate	ASTM C533	I		No
	Cellular Glass	ASTM C552	II	2	No
Condensate Drain Located Inside Building					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
Note: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2						
Piping Insulation Thickness (inch) Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.						
Service						
	Material	Tube And Pipe Size (inch)				
		<1	1-<1.5	1.5-<4	4-<8	> or = >8
Chilled Water (Supply & Return, 40 Degrees F nominal)						
	Cellular Glass	1.5	2	2	2.5	3
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
Heating Hot Water Supply & Return (Max 250 F)						
	Mineral Fiber	1.5	1.5	2	2	2

TABLE 2						
Piping Insulation Thickness (inch) Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.						
Service						
	Material	Tube And Pipe Size (inch)				
		<1	1-<1.5	1.5-<4	4-<8	> or = >8
	Calcium Silicate	2.5	2.5	3	3	3
	Cellular Glass	2	2.5	3	3	3
Condensate Drain Located Inside Building						
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Chilled water.

b. Air conditioner condensate drains.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field Applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, sliver, white, black and embossed for use with Mineral Fiber, and Cellular Glass Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3 ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white and black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3 ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white and black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft

level. Other areas that specifically require protection are exterior chilled water and refrigerant piping at any height.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

Apply insulation to the pipe with tight butt joints. Seal all butted joints and ends with joint sealant and seal with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

3.2.2.3.1 Longitudinal Laps of the Jacket Material

Overlap not less than 1-1/2 inches. Provide butt strips 3 inches wide for circumferential joints.

3.2.2.3.2 Laps and Butt Strips

Secure with adhesive and staple on 4 inch centers if not factory self-sealing. If staples are used, seal in accordance with paragraph STAPLES below. Note that staples are not required with cellular glass systems.

3.2.2.3.3 Factory Self-Sealing Lap Systems

May be used when the ambient temperature is between 40 and 120 degrees F during installation. Install the lap system in accordance with manufacturer's recommendations. Use a stapler only if specifically recommended by the manufacturer. Where gaps occur, replace the section or repair the gap by applying adhesive under the lap and then stapling.

3.2.2.3.4 Staples

Coat all staples, including those used to repair factory self-seal lap systems, with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - 0.0000 perm adhesive tape. Coat all seams, except those on factory self-seal systems, with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

3.2.2.3.5 Breaks and Punctures in the Jacket Material

Patch by wrapping a strip of jacket material around the pipe and secure it with adhesive, staple, and coat with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Extend the patch not less than 1-1/2 inches past the break.

3.2.2.3.6 Penetrations Such as Thermometers

Fill the voids in the insulation and seal with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

3.2.2.3.7 Flexible Elastomeric Cellular Pipe Insulation

Install by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. Secure all seams and butt joints and seal with adhesive. When using self seal products only the butt joints shall

be secured with adhesive. Push insulation on the pipe, never pulled. Stretching of insulation may result in open seams and joints. Clean cut all edges. Rough or jagged edges of the insulation are not be permitted. Use proper tools such as sharp knives. Do not stretch Grade 1, Type II sheet insulation around the pipe when used on pipe larger than 6 inches. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow". Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

   (1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.

   (2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a

vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding made for securing PVC covers. Seams in the cover, and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Hot water heating.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

3.2.3.2.1 Precut or Preformed

Place precut or preformed insulation around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

3.2.3.2.2 Rigid Preformed

Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments

shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket, or stainless steel jacket shall be applied.

Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with metal jacketing/flashing sealant while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant.

3.2.4.3 Stainless Steel Jackets

ASTM A167 or ASTM A240/A240M; Type 304, minimum thickness of 33 gauge (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 1/2-inch.

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Install duct insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions. Duct insulation minimum thickness and insulation level must be as listed in Table 3 and must meet or exceed the requirements of ASHRAE 90.1 - SI.

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Duct insulation shall be omitted on exposed return ducts in air conditioned spaces unless otherwise shown. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Minimum Thickness

Duct insulation minimum thickness in accordance with Table 4.

Table 4 - Minimum Duct Insulation (inches)	
Cold Air Ducts	2.0
Relief and Return Ducts	1.5
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts (where concealed in plenums).

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil headers and return bends.

h. Coil casings.

i. Fresh air intake ducts.

j. Filter boxes.

k. Site-erected air conditioner casings.

l. Ducts exposed to weather.

m. Exhaust plenums and ductwork located between exterior wall or roof and

control damper.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 30 00 HVAC AIR DISTRIBUTION.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.

d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.

f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all

directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches. Mechanical fasteners shall be as corrosion resistant as G60 coated galvanized steel, and shall indefinitely sustain a 50 lb tensile dead load test perpendicular to the duct wall.

b. Form duct insulation with minimum jacket seams. Fasten each piece of rigid insulation to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder/barrier jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors.

c. Impale insulation on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.

d. Seal joints in the insulation jacket with a 4 inch wide strip of tape. Seal taped seams with a brush coat of vapor retarder coating.

e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a flashing sealant.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 3/4 pcf, attached as in accordance with MICA standards.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts.

d. Flexible run-outs (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil-headers and return bends.

h. Coil casings.

i. Fresh air intake ducts.

j. Exhaust ducts passing through concealed spaces exhausting conditioned air.

k. Exhaust plenums and ductwork located between exterior wall or roof and control damper.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.

b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.

d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.

e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 60 degrees F, ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.3.6 Duct Exposed to Weather

3.3.6.1 Installation

Ducts exposed to weather shall be insulated and finished as specified for the applicable service for exposed duct inside the building. After the above is accomplished, the insulation shall then be further finished as detailed in the following subparagraphs.

3.3.6.2 Round Duct

Laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - Less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply, heavy duty, white and natural) membrane shall be applied overlapping material by 3 inches no bands or caulking needed - see manufacturer's recommended installation instructions. Aluminum jacket with factory applied moisture retarder shall be applied with the joints lapped not less than 3 inches and secured with bands located at circumferential laps and at not more than 12 inch intervals throughout. Horizontal joints shall lap down to shed water and located at 4 or 8 o'clock position. Joints shall be sealed with metal jacketing sealant to prevent moisture penetration. Where jacketing abuts an un-insulated surface, joints shall be sealed with metal jacketing sealant.

3.3.6.3 Fittings

Fittings and other irregular shapes shall be finished as specified for rectangular ducts.

3.3.6.4 Rectangular Ducts

Two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application shall be applied to the entire surface. Each coat of weatherproof mastic shall be 1/16-inch minimum thickness. The exterior shall be a metal jacketing applied for mechanical abuse and weather protection, and secured with screws or vapor barrier/weatherproofing jacket less than 0.0000 permeability greater than 3 ply, standard grade, silver, white, black, and embossed or greater than 8 ply, heavy duty white and natural. Membrane shall be applied overlapping material by 3 inches. No bands or caulking needed-see manufacturing recommend installation instructions.

3.4 EQUIPMENT INSULATION SYSTEMS INSTALLATION

Install equipment insulation systems in accordance with the approved

MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Hand-holes.

b. Cleanouts.

c. ASME stamps.

d. Manufacturer's nameplates.

e. Duct Test/Balance Test Holes.

3.4.2 Insulation for Cold Equipment

Cold equipment below 60 degrees F: Insulation shall be furnished on equipment handling media below 60 degrees F including the following:

a. Drip pans under chilled equipment.

b. Air handling equipment parts that are not factory insulated.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Material and thicknesses shall be as shown in Table 5:

TABLE 5		
Insulation Thickness for Cold Equipment (inches)		
Equipment handling media at indicated temperature		
	Material	Thickness (inches)
35 to 60 degrees F		
	Cellular Glass	1.5
	Flexible Elastomeric Cellular	1
1 to 34 degrees F		
	Cellular Glass	3
	Flexible Elastomeric Cellular	1.5
Minus 30 to 0 degrees F		
	Cellular Glass	3.5

TABLE 5		
Insulation Thickness for Cold Equipment (inches)		
Equipment handling media at indicated temperature		
	Material	Thickness (inches)
	Flexible Elastomeric Cellular	1.75

3.4.2.2 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch centers except flexible elastomeric cellular which shall be adhered with contact adhesive. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Cellular glass shall be installed in accordance with manufacturer's instructions. Joints and ends shall be sealed with joint sealant, and sealed with a vapor retarder coating.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 6 by 6 inches by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 by 2 inches washers or shall be securely banded or wired in place on 12 inch centers.

3.4.2.3 Vapor Retarder/Vapor Barrier

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating or vapor barrier jacket shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Flashing sealant or vapor barrier tape shall be applied to parting line between equipment and removable section insulation.

3.4.3 Equipment Handling Dual Temperature Media

Below and above 60 degrees F: Equipment handling dual temperature media shall be insulated as specified for cold equipment.

3.4.4 Equipment Exposed to Weather

3.4.4.1 Installation

Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

3.4.4.2 Optional Panels

At the option of the Contractor, prefabricated metal insulation panels may be used in lieu of the insulation and finish previously specified. Thermal performance shall be equal to or better than that specified for field applied insulation. Panels shall be the standard catalog product of a manufacturer of metal insulation panels. Fastenings, flashing, and support system shall conform to published recommendations of the manufacturer for weatherproof installation and shall prevent moisture from entering the insulation. Panels shall be designed to accommodate thermal expansion and to support a 250 pound walking load without permanent deformation or permanent damage to the insulation. Exterior metal cover sheet shall be aluminum and exposed fastenings shall be stainless steel or aluminum.

-- End of Section --

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC
02/19

PART 1 GENERAL

1.1 SUMMARY

Provide a complete Direct Digital Control (DDC) system suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as indicated and shown and in accordance with Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for BACnet systems, and other referenced Sections.

1.1.1 Compatibility

Provide systems compatible with the buildings existing Johnson Controls Metasys system.

1.1.2 System Requirements

Provide systems meeting the requirements this Section and other Sections referenced by this Section, and which have the following characteristics:

a. The system implements the control sequences of operation shown in the Contract Drawings using DDC hardware to control mechanical and electrical equipment.

b. The system meet the requirements of this specification as a stand-alone system and does not require connection to any other system.

c. Control sequences reside in DDC hardware in the building. The building control network is not dependent upon connection to a Energy Monitoring and Control System (EMCS) Front End or to any other system for performance of control sequences. To the greatest extent practical, the hardware performs control sequences without reliance on the building network, unless otherwise pre-approved by the Contracting Officer.

d. The hardware is installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

e. All necessary documentation, configuration information, programming tools, programs, drivers, and other software are licensed to and otherwise remain with the Government such that the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer.

f. Sufficient documentation and data, including rights to documentation and data, are provided such that the Government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor, Vendor or Manufacturer.

g. Hardware is installed and configured such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the Contractor, Vendor or Manufacturer.

1.1.3 End to End Accuracy

Select products, install and configure the system such that the maximum error of a measured value as read from the DDC Hardware over the network is less than the maximum allowable error specified for the sensor or instrumentation.

1.1.4 Verification of Dimensions

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.1.5 Drawings

The Government will not indicate all offsets, fittings, and accessories that may be required on the drawings. Carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, arrange such work accordingly, and provide all work necessary to meet such conditions.

1.2 RELATED SECTIONS

Related work specified elsewhere:

a. Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for BACnet systems.

b. Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2016) BACnet—A Data Communication Protocol for Building Automation and Control Networks
ASHRAE FUN IP	(2017) Fundamentals Handbook, I-P Edition

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment

(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 5085-3	(2006; Reprint Nov 20121) Low Voltage Transformers - Part 3: Class 2 and Class 3 Transformers

1.4 DEFINITIONS

The following list of definitions includes terms used in Sections referenced by this Section and are included here for completeness. The definitions contained in this Section may disagree with how terms are defined or used in other documents, including documents referenced by this Section. The definitions included here are the authoritative definitions for this Section and all Sections referenced by this Section.

After each term the protocol related to that term is included in parenthesis.

1.4.1 Alarm Generation (All protocols)

Alarm Generation is the monitoring of a value, comparison of the value to alarm conditions and the creation of an alarm when the conditions set for the alarm are met.

1.4.2 Building Automation and Control Network (BACnet) (BACnet)

The term BACnet is used in two ways. First meaning the BACnet Protocol Standard - the communication requirements as defined by ASHRAE 135 including all annexes and addenda. The second to refer to the overall technology related to the ASHRAE 135 protocol.

1.4.3 BACnet Advanced Application Controller (B-AAC) (BACnet)

A hardware device BTL Listed as a B-AAC, which is required to support BACnet Interoperability Building Blocks (BIBBs) for scheduling and alarming, but is not required to support as many BIBBs as a B-BC.

1.4.4 BACnet Application Specific Controller (B-ASC) (BACnet)

A hardware device BTL Listed as a B-ASC, with fewer BIBB requirements than a B-AAC. It is intended for use in a specific application.

1.4.5 BACnet Building Controller (B-BC) (BACnet)

A hardware device BTL Listed as a B-BC. A general-purpose, field-programmable device capable of carrying out a variety of building automation and control tasks including control and monitoring via direct digital control (DDC) of specific systems and data storage for trend

information, time schedules, and alarm data. Like the other BTL Listed controller types (B-AAC, B-ASC etc.) a B-BC device is required to support the server ("B") side of the ReadProperty and WriteProperty services, but unlike the other controller types it is also required to support the client ("A") side of these services. Communication between controllers requires that one of them support the client side and the other support the server side, so a B-BC is often used when communication between controllers is needed.

1.4.6 BACnet Broadcast Management Device (BBMD) (BACnet)

A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Each IP subnet that is part of a BACnet/IP network must have at least one BBMD. Note there are additional restrictions when multiple BBMDs share an IP subnet.

1.4.7 BACnet/IP (BACnet)

An extension of BACnet, Annex J, defines the use of a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnets that share the same BACnet network number. See also paragraph BACNET BROADCAST MANAGEMENT DEVICE.

1.4.8 BACnet Internetwork (BACnet)

Two or more BACnet networks, connected with BACnet routers. In a BACnet Internetwork, there exists only one message path between devices.

1.4.9 BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more ASHRAE 135 Services intended to define a higher level of interoperability. BIBBs are combined to build the BACnet functional requirements for a device in a specification. Some BIBBs define additional requirements (beyond requiring support for specific services) in order to achieve a level of interoperability. For example, the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by a front-end, not only requires the client to support the ReadProperty Service, but also provides a list of data types (Object / Properties) which the client must be able to interpret and display for the user.

In the BIBB shorthand notation, -A is the client side and -B is the server side.

The following is a list of some BIBBs used by this or referenced Sections:	
DS-COV-A	Data Sharing-Change of Value (A side)
DS-COV-B	Data Sharing-Change of Value (B side)
NM-RC-B	Network Management-Router Configuration (B side)
DS-RP-A	Data Sharing-Read Property (A side)
DS-RP-B	Data Sharing-Read Property (B side)

The following is a list of some BIBBs used by this or referenced Sections:	
DS-RPM-A	Data Sharing-Read Property Multiple (A Side)
DS-RPM-B	Data Sharing-Read Property Multiple (B Side)
DS-WP-A	Data Sharing-Write Property (A Side)
DM-TS-B	Device Management-Time Synchronization (B Side)
DM-UTC-B	Device Management-UTC Time Synchronization (B Side)
DS-WP-B	Data Sharing-Write Property (B side)
SCHED-E-B	Scheduling-External (B side)
DM-OCD-B	Device Management-Object Creation and Deletion (B side)
AE-N-I-B	Alarm and Event-Notification Internal (B Side)
AE-N-E-B	Alarm and Event-Notification External (B Side)
T-VMT-I-B	Trending-Viewing and Modifying Trends Internal (B Side)
T-VMT-E-B	Trending-Viewing and Modifying Trends External (B Side)

1.4.10 BACnet Network (BACnet)

In BACnet, a portion of the control Internetwork consisting of one or more segments connected by repeaters. Networks are separated by routers.

1.4.11 BACnet Operator Display (B-OD) (BACnet)

A basic operator interface with limited capabilities relative to a B-OWS. It is not intended to perform direct digital control. A B-OD profile could be used for LCD devices, displays affixed to BACnet devices, handheld terminals or other very simple user interfaces.

1.4.12 BACnet Segment (BACnet)

One or more physical segments interconnected by repeaters (ASHRAE 135).

1.4.13 BACnet Smart Actuator (B-SA) (BACnet)

A simple actuator device with limited resources intended for specific applications.

1.4.14 BACnet Smart Sensor (B-SS) (BACnet)

A simple sensing device with limited resources.

1.4.15 BACnet Testing Laboratories (BTL) (BACnet)

Established by BACnet International to support compliance testing and

interoperability testing activities and consists of BTL Manager and the BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.4.16 BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been listed by BACnet Testing Laboratory. Devices may be certified to a specific device profile, in which case the listing indicates that the device supports the required capabilities for that profile, or may be listed as "other".

1.4.17 Binary (All protocols)

A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

1.4.18 Broadcast (BACnet)

Unlike most messages, which are intended for a specific recipient device, a broadcast message is intended for all devices on the network.

1.4.19 Building Control Network (BCN) (All protocols)

The network connecting all DDC Hardware within a building (or specific group of buildings).

1.4.20 Building Point of Connection (BPOC) (All protocols)

A FPOC for a Building Control System. (This term is being phased out of use in preference for FPOC but is still used in some specifications and criteria. When it was used, it typically referred to a piece of control hardware. The current FPOC definition typically refers instead to IT hardware.)

1.4.21 Commandable (All protocols)

See Overridable.

1.4.22 Commandable Objects (BACnet)

Commandable Objects have a Commandable Property, Priority_Array, and Relinquish_Default Property as defined in ASHRAE 135, Clause 19.2, Command Prioritization.

1.4.23 Configurable (All protocols)

A property, setting, or value is configurable if it can be changed via hardware settings on the device, via the use of engineering software or over the control network from the front end, and is retained through (after) loss of power.

In a BACnet system, a property, setting, or value is configurable if it can be changed via one or more of:

1) via BACnet services (including proprietary BACnet services)
2) via hardware settings on the device

Note this is more stringent than the ASHRAE 135 definition.

1.4.24 Control Logic Diagram (All protocols)

A graphical representation of control logic for multiple processes that make up a system.

1.4.25 Device (BACnet)

A Digital Controller that contains a BACnet Device Object and uses BACnet to communicate with other devices.

1.4.26 Device Object (BACnet)

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet Internetwork. This number is often referred to as the device instance or device ID.

1.4.27 Device Profile (BACnet)

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE 135. Standard device profiles include BACnet Advanced Workstations (B-AWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS).

1.4.28 Digital Controller (All protocols)

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions.

1.4.29 Direct Digital Control (DDC) (All protocols)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.4.30 Field Point of Connection (FPOC) (All protocols)

The FPOC is the point of connection between the EMCS IP Network and the field control network (either an IP network, a non-IP network, or a combination of both). The hardware at this location which provides the connection is generally an IT device such as a switch, IP router, or firewall.

In general, the term "FPOC Location" means the place where this connection occurs, and "FPOC Hardware" means the device that provides the connection. Sometimes the term "FPOC" is used to mean either and its actual meaning (i.e., location or hardware) is determined by the context in which it is used.

1.4.31 Gateway (All protocols)

A device that translates from one protocol application data format to another. Devices that change only the transport mechanism of the protocol - "translating" from TP/FT-10 to Ethernet/IP or from BACnet MS/TP to BACnet over IP for example - are not gateways as the underlying data format does not change. Gateways are also called Communications Bridges

or Protocol Translators.

1.4.32 IEEE 802.3 Ethernet (All protocols)

A family of local-area-network technologies providing high-speed networking features over various media, typically Cat 5, 5e or Cat 6 twisted pair copper or fiber optic cable.

1.4.33 Internet Protocol (IP, TCP/IP, UDP/IP) (All protocols)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes connections, also known as "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.4.34 Input/Output (I/O) (All protocols)

Physical inputs and outputs to and from a device, although the term sometimes describes network or "virtual" inputs or outputs. See also "Points".

1.4.35 I/O Expansion Unit (All protocols)

An I/O expansion unit provides additional point capacity to a digital controller.

1.4.36 IP subnet (All protocols)

A group of devices which share a defined range IP addresses. Devices on a common IP subnet can share data (including broadcasts) directly without the need for the traffic to traverse an IP router.

1.4.37 Local-Area Network (LAN) (All protocols)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.4.38 Local Display Panels (LDPs) (All protocols)

A DDC Hardware with a display and navigation buttons, and must provide display and adjustment of points as shown on the Points Schedule and as indicated.

1.4.39 MAC Address (All protocols)

Media Access Control address. The physical device address that identifies a device on a Local Area Network.

1.4.40 Master-Slave/Token-Passing (MS/TP) (BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds (data rates) are permitted by the BACnet MS/TP standard.

1.4.41 Monitoring and Control (M&C) Software (All protocols)

The EMCS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

1.4.42 Network Number (BACnet)

A site-specific number assigned to each network. This network number must be unique throughout the BACnet Internetwork.

1.4.43 Object (BACnet)

An ASHRAE 135 Object. The concept of organizing BACnet information into standard components with various associated Properties. Examples include Analog Input objects and Binary Output objects.

1.4.44 Object Identifier (BACnet)

A grouping of two Object properties: Object Type (e.g., Analog Value, Schedule, etc.) and Object Instance (in this case, a number). Object Identifiers must be unique within a device.

1.4.45 Object Instance (BACnet)

See paragraph OBJECT IDENTIFIER.

1.4.46 Object Properties (BACnet)

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.4.47 Operator Configurable (All protocols)

Operator configurable values are values that can be changed from a single common front end user interface across multiple vendor systems.

For non Niagara-based BACnet systems, a property, setting, or value in a device is Operator Configurable when it is Configurable and is either:

a. A Writable Property of a Standard BACnet Object; or

b. A Property of a Standard BACnet Object that is Writable when Out_Of_Service is TRUE and Out_Of_Service is Writable.

1.4.48 Override (All protocols)

Changing the value of a point outside of the normal sequence of operation where the change has priority over the sequence and where there is a mechanism for releasing the change such that the point returns to the normal value. Overrides persist until released or overridden at the same or higher priority but are not required to persist through a loss of power. Overrides are often used by operators to change values, and generally originate at a user interface (workstation or local display panel).

1.4.49 Packaged Equipment (All protocols)

Packaged equipment is a single piece of equipment provided by a manufacturer in a substantially complete and operable condition, where the controls (DDC Hardware) are factory installed, and the equipment is sold and shipped from the manufacturer as a single entity. Disassembly and reassembly of a large piece of equipment for shipping does not prevent it from being packaged equipment. Package units may require field installation of remote sensors. Packaged equipment is also called a "packaged unit".

Note industry may use the term "Packaged System" to mean a collection of equipment that is designed to work together where each piece of equipment is packaged equipment and there is a network that connects the equipment together. A "packaged system" of this type is NOT packaged equipment; it is a collection of packaged equipment, and each piece of equipment must individually meet specification requirements.

1.4.50 Packaged Unit (All protocols)

See packaged equipment.

1.4.51 Performance Verification Test (PVT) (All protocols)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.4.52 Physical Segment (BACnet)

A single contiguous medium to which BACnet devices are attached (ASHRAE 135).

1.4.53 Polling (All protocols)

A device periodically requesting data from another device.

1.4.54 Points (All protocols)

Physical and virtual inputs and outputs. See also paragraph INPUT/OUTPUT (I/O).

1.4.55 Proportional, Integral, and Derivative (PID) Control Loop (All protocols)

Three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.4.56 Proprietary (BACnet)

Within the context of BACnet, any extension of or addition to object types, properties, PrivateTransfer services, or enumerations specified in ASHRAE 135. Objects with Object_Type values of 128 and above are Proprietary Objects. Properties with Property_Identifier of 512 and above are proprietary Properties.

1.4.57 Protocol Implementation Conformance Statement (PICS) (BACnet)

A document, created by the manufacturer of a device, which describes which portions of the BACnet standard may be implemented by a given device. ASHRAE 135 requires that all ASHRAE 135 devices have a PICS, and also defines a minimum set of information that must be in it. A device as installed for a specific project may not implement everything in its PICS.

1.4.58 Repeater (All protocols)

A device that connects two control network segments and retransmits all information received on one side onto the other.

1.4.59 Router (All protocols)

A device that connects two ASHRAE 135 networks and controls traffic between the two by retransmitting signals received from one side onto the other based on the signal destination. Routers are used to subdivide a BACnet internetwork and to limit network traffic.

1.4.60 Segment (All protocols)

A 'single' section of a control network that contains no repeaters or routers. There is generally a limit on the number of devices on a segment, and this limit is dependent on the topology/media and device type.

1.4.61 Standard BACnet Objects (BACnet)

Objects with Object_Type values below 128 and specifically enumerated in Clause 21 of ASHRAE 135. Objects which are not proprietary. See paragraph PROPRIETARY.

1.4.62 Standard BACnet Properties (BACnet)

Properties with Property_Identifier values below 512 and specifically enumerated in Clause 21 of ASHRAE 135. Properties which are not proprietary. See Proprietary.

1.4.63 Standard BACnet Services (BACnet)

ASHRAE 135 services other than ConfirmedPrivateTransfer or UnconfirmedPrivateTransfer. See paragraph PROPRIETARY.

1.4.64 EMCS (All protocols)

EMCS stands for Energy Monitoring and Control System. The term refers to all components by which a project site monitors, manages, and controls real-time operation of HVAC and other building systems. These components include the EMCS "front-end" and all field building control systems connected to the front-end. The front-end consists of Monitoring and Control Software (user interface software), browser-based user interfaces and network infrastructure.

The network infrastructure (the "EMCS Network"), is an IP network connecting multiple building or facility control networks to the Monitoring and Control Software.

1.4.65 EMCS Network (All protocols)

The EMCS Network connects multiple building or facility control networks to the Monitoring and Control Software.

1.4.66 Writable Property (BACnet)

A Property is Writable when it can be changed through the use of one or more of the WriteProperty services defined in ASHRAE 135, Clause 15 regardless of the value of any other Property. Note that in the ASHRAE 135 standard, some Properties may be writable when the Out of Service Property is TRUE; for purposes of this Section, Properties that are only writable when the Out of Service Property is TRUE are not considered to be Writable.

1.5 PROJECT SEQUENCING

TABLE II. PROJECT SEQUENCING lists the sequencing of submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column) and activities as specified in PART 3 EXECUTION (denoted by an 'E' in the 'TYPE' column). TABLE II does not specify overall project milestone and completion dates.

a. Sequencing for Submittals: The sequencing specified for submittals is the deadline by which the submittal must be initially submitted to the Government. Following submission there will be a Government review period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within 14 days of notification that the submittal has been rejected. Upon resubmittal there will be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

b. Sequencing for Activities: The sequencing specified for activities indicates the earliest the activity may begin.

c. Abbreviations: In TABLE II the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

TABLE II. PROJECT SEQUENCING

ITEM #	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY OR DEADLINE FOR SUBMITTAL)
2	S	DDC Contractor Design Drawings	
3	S	Manufacturer's Product Data	
4	S	Pre-construction QC Checklist	
5	E	Install Building Control System	AAO #1 thru #4
6	E	Start-Up and Start-Up Testing	ACO #5

TABLE II. PROJECT SEQUENCING			
ITEM #	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY OR DEADLINE FOR SUBMITTAL)
7	S	Post-Construction QC Checklist	ACO #6
8	S	Programming Software Configuration Software	ACO #6
9	S	Draft As-Built Drawings	ACO #6
10	S	Start-Up Testing Report	ACO #6
11	S	PVT Procedures	before schedule start of #12 and AAO #10
12	E	Execute PVT	AAO #9 and #11
13	S	PVT Report	ACO #12
14	S	Controller Application Programs Controller Configuration Settings	AAO #13
15	S	Final As-Built Drawings	AAO #13
16	S	O&M Instructions	AAO #15
17	S	Training Documentation	AAO #10 and before scheduled start of #18
18	E	Training	AAO #16 and #17
19	S	Closeout QC Checklist	ACO #18

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

DDC Contractor Design Drawings; G

Draft As-Built Drawings; G RO

Final As-Built Drawings; G RO

SD-03 Product Data

Programming Software; G

Controller Application Programs; G

Configuration Software; G

Controller Configuration Settings; G

Manufacturer's Product Data; G

SD-06 Test Reports

Start-Up Testing Report; G RO

PVT Procedures; G RO

PVT Report; G RO

Pre-Construction Quality Control (QC) Checklist; G RO

Post-Construction Quality Control (QC) Checklist; G RO

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G RO

Training Documentation; G RO

SD-11 Closeout Submittals

Enclosure Keys; G RO

Closeout Quality Control (QC) Checklist; G RO

1.7 DATA PACKAGE AND SUBMITTAL REQUIREMENTS

Technical data packages consisting of technical data and computer software (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications must be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered must be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered 'shop drawings' under the Federal Acquisition Regulation Supplement (FARS) and must contain no proprietary information and be delivered with unrestricted rights.

1.8 SOFTWARE FOR DDC HARDWARE AND GATEWAYS

Provide all software related to the programming and configuration of DDC Hardware and Gateways as indicated. License all Software to the project site. The term "controller" as used in these requirements means both DDC Hardware and Gateways.

1.8.1 Configuration Software

For each type of controller, provide the configuration tool software in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS. Submit hard copies of the software user manuals for each software with the software submittal.

Submit Configuration Software on CD-ROM as a Technical Data Package. Submit hard copies of the software user manual for each piece of software.

1.8.2 Controller Configuration Settings

For each controller, provide copies of the installed configuration settings as source code compatible with the configuration tool software for that controller in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Controller Configuration Settings on CD-ROM as a Technical Data Package. Include on the CD-ROM a list or table of contents clearly indicating which files are associated with each device. Submit 2 copies of the Controller Configuration Settings CD-ROM.

1.8.3 Programming Software

For each type of programmable controller, provide the programming software in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS. Submit hard copies of software user manuals for each software with the software submittal.

Submit Programming Software on CD-ROM as a Technical Data Package. Submit hard copies of the software user manual for each piece of software.

1.8.4 Controller Application Programs

For each programmable controller, provide copies of the application program as source code compatible with the programming software for that controller in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Controller Application Programs on CD-ROM as a Technical Data Package. Include on the CD-ROM a list or table of contents clearly indicating which application program is associated with each device. Submit 2 copies of the Controller Application Programs CD-ROM.

1.9 QUALITY CONTROL CHECKLISTS

The QC Checklist for BACnet Systems in APPENDIX A of this Section must be completed by the Contractor's Chief Quality Control (QC) Representative and submitted as indicated.

The QC Representative must verify each item indicated and initial in the space provided to indicate that the requirement has been met. The QC Representative must sign and date the Checklist prior to submission to the Government.

1.9.1 Pre-Construction Quality Control (QC) Checklist

Complete items indicated as Pre-Construction QC Checklist items in the QC Checklist. Submit four copies of the Pre-Construction QC Checklist.

1.9.2 Post-Construction Quality Control (QC) Checklist

Complete items indicated as Post-Construction QC Checklist items in the QC Checklist. Submit four copies of the Post-Construction QC Checklist.

1.9.3 Closeout Quality Control (QC) Checklist

Complete items indicated as Closeout QC Checklist items in the QC Checklist. Submit four copies of the Closeout QC Checklist.

PART 2 PRODUCTS

Provide products meeting the requirements of Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for BACnet, other referenced Sections, and this Section.

2.1 GENERAL PRODUCT REQUIREMENTS

Units of the same type of equipment must be products of a single manufacturer. Each major component of equipment must have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment must be standard products of a manufacturer regularly engaged in the manufacturing of these and similar products. The standard products must have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two year use must include applications of equipment and materials under similar circumstances and of similar size. DDC Hardware not meeting the two-year field service requirement is acceptable provided it has been successfully used by the Contractor in a minimum of two previous projects. The equipment items must be supported by a service organization. Items of the same type and purpose must be identical, including equipment, assemblies, parts and components.

2.2 PRODUCT DATA

Provide manufacturer's product data sheets documenting compliance with product specifications for each product provided under Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS, or this Section. Provide product data for all products in a single indexed compendium, organized by product type.

For all BACnet hardware: For each manufacturer, model and version (revision) of DDC Hardware provide the Protocol Implementation Conformance Statement (PICS) in accordance with Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Submit Manufacturer's Product Data on CD-ROM.

2.3 OPERATION ENVIRONMENT

Unless otherwise specified, provide products rated for continuous operation under the following conditions:

a. Pressure: Pressure conditions normally encountered in the installed location.

b. Vibration: Vibration conditions normally encountered in the installed location.

c. Temperature:

(1) Products installed indoors: Ambient temperatures in the range of 32 to 112 degrees F and temperature conditions outside this range normally encountered at the installed location.

(2) Products installed outdoors or in unconditioned indoor spaces: Ambient temperatures in the range of minus 35 to plus 151 degrees F and temperature conditions outside this range normally encountered at the installed location.

d. Humidity: 10 to 95 percent relative humidity, noncondensing and humidity conditions outside this range normally encountered at the installed location.

2.4 WIRELESS CAPABILITY

For products incorporating any wireless capability (including but not limited to radio frequency (RF), infrared and optical), provide products for which wireless capability has been permanently removed at the device.

2.5 ENCLOSURES

Enclosures supplied as an integral (pre-packaged) part of another product are acceptable. Provide two Enclosure Keys for each lockable enclosure on a single ring per enclosure with a tag identifying the enclosure the keys operate. Provide enclosures meeting the following minimum requirements:

2.5.1 Mechanical and Electrical Rooms

For enclosures located in mechanical or electrical rooms, provide enclosures meeting NEMA 250 Type 2 requirements.

2.5.2 Other Locations

For enclosures in other locations including but not limited to occupied spaces, above ceilings, and in plenum returns, provide enclosures meeting NEMA 250 Type 1 requirements.

2.6 WIRE AND CABLE

Provide wire and cable meeting the requirements of NFPA 70 and NFPA 90A in addition to the requirements of this specification and referenced specifications.

2.6.1 Terminal Blocks

For terminal blocks which are not integral to other equipment, provide terminal blocks which are insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, suitable for DIN rail mounting, and which have enclosed sides or end plates and partition plates for separation.

2.6.2 Control Wiring for Binary Signals

For Control Wiring for Binary Signals, provide 18 AWG copper or thicker

wire rated for 300-volt service.

2.6.3 Control Wiring for Analog Signals

For Control Wiring for Analog Signals, provide 18 AWG or thicker, copper, single- or multiple-twisted wire meeting the following requirements:

a. Minimum 2 inch lay of twist.

b. 100 percent shielded pairs.

c. At least 300-volt insulation.

d. Each pair has a 20 AWG tinned-copper drain wire and individual overall pair insulation.

e. Cables have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.6.4 Power Wiring for Control Devices

For 24-volt circuits, provide insulated copper 18 AWG or thicker wire rated for 300 VAC service. For 120-volt circuits, provide 14 AWG or thicker stranded copper wire rated for 600-volt service.

2.6.5 Transformers

Provide UL 5085-3 approved transformers. Select transformers sized so that the connected load is no greater than 80 percent of the transformer rated capacity.

2.6.6 Power Source

Each device requiring power shall either derive the power from the device being controlled or from the electrical circuit noted for DOC controls on electrical plans. Contractor is responsible for routing power to the device.

PART 3 EXECUTION

3.1 INSTALLATION

Fully install and test the control system in accordance Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC, Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS for BACnet, and this Section.

3.1.1 Dielectric Isolation

Provide dielectric isolation where dissimilar metals are used for connection and support. Install control system in a matter that provides clearance for control system maintenance by maintaining access space required to calibrate, remove, repair, or replace control system devices. Install control system such that it does not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.2 Penetrations in Building Exterior

Make all penetrations through and mounting holes in the building exterior watertight.

3.1.3 Device Mounting Criteria

Install devices in accordance with the manufacturer's recommendations and as indicated and shown. Provide a weathershield for all devices installed outdoors. Provide clearance for control system maintenance by maintaining access space required to calibrate, remove, repair, or replace control system devices. Provide clearance for mechanical and electrical system maintenance; do not not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.4 Labels and Tags

Key all labels and tags to the unique identifiers shown on the As-Built drawings. For labels exterior to protective enclosures provide engraved plastic labels mechanically attached to the enclosure or DDC Hardware. Labels inside protective enclosures may be attached using adhesive, but must not be hand written. For tags, provide plastic or metal tags mechanically attached directly to each device or attached by a metal chain or wire.

a. Label all Enclosures and DDC Hardware.

b. Tag Airflow measurement arrays (AFMA) with flow rate range for signal output range, duct size, and pitot tube AFMA flow coefficient.

c. Tag duct static pressure taps at the location of the pressure tap.

3.1.5 Surge Protection

3.1.5.1 Power-Line Surge Protection

Protect equipment connected to AC circuits to withstand power-line surges in accordance with IEEE C62.41. Do not use fuses for surge protection.

3.1.5.2 Surge Protection for Transmitter and Control Wiring

Protect DDC hardware against or provided DDC hardware capable of withstanding surges induced on control and transmitter wiring installed outdoors and as shown. Protect equipment against the following two waveforms:

a. A waveform with a 10-microsecond rise time, a 1000-microsecond decay time and a peak current of 60 amps.

b. A waveform with an 8-microsecond rise time, a 20-microsecond decay time and a peak current of 500 amperes.

3.1.6 Basic Cybersecurity Requirements

3.1.6.1 IP Network Physical Security

Install all IP Network media in conduit. Install all IP devices including but not limited to IP-enabled DDC hardware and IP Network Hardware in lockable enclosures.

3.2 DRAWINGS AND CALCULATIONS

Provide drawings in the form and arrangement indicated and shown. Use the same abbreviations, symbols, nomenclature and identifiers shown. Assign a unique identifier as shown to each control system element on a drawing. When packaging drawings, group schedules by system. When space allows, it is permissible to include multiple schedules for the same system on a single sheet. Except for drawings covering all systems, do not put information for different systems on the same sheet.

Submit hardcopy drawings on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in PDF and in AutoCAD format. In addition, submit electronic drawings in editable Excel format for all drawings that are tabular, including but not limited to the Point Schedule and Equipment Schedule.

a. Submit DDC Contractor Design Drawings consisting of each drawing indicated with pre-construction information depicting the intended control system design and plans. Submit DDC Contractor Design Drawings as a single complete package: 1 hard copy and 1 copy on CD-ROM.

b. Submit Draft As-Built Drawings consisting of each drawing indicated updated with as-built data for the system prior to PVT. Submit Draft As-Built Drawings as a single complete package: 1 hard copy and 1 copy on CD-ROM.

c. Submit Final As-Built Drawings consisting of each drawing indicated updated with all final as-built data. Final As-Built Drawings as a single complete package: 1 hard copy and 1 copy on CD-ROM.

3.2.1 Sample Drawings

Sample drawings in electronic format are available at the Whole Building Design Guide page for this section:
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-23-09-00
These drawings may prove useful in demonstrating expected drawing formatting and example content and are provided for illustrative purposes only. Note that these drawings do not meet the content requirements of this Section and must be completed to meet project requirements.

3.2.2 Drawing Index and Legend

Provide an HVAC Control System Drawing Index showing the name and number of the building, military site, State or other similar designation, and Country. In the Drawing Index, list all Contractor Design Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. In the Design Drawing Legend, show and describe all symbols, abbreviations and acronyms used on the Design Drawings. Provide a single Index and Legend for the entire drawing package.

3.2.3 Thermostat and Occupancy Sensor Schedule

Provide a thermostat and occupancy sensor schedule containing each thermostat's unique identifier, room identifier and control features and functions as shown. Provide a single thermostat and occupancy sensor schedule for the entire project.

3.2.4 Valve Schedule

Provide a valve schedule containing each valve's unique identifier, size, flow coefficient Kv (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure to torque data, dimensions, and access and clearance requirements data. In the valve schedule include actuator selection data supported by calculations of the force required to move and seal the valve, access and clearance requirements. Provide a single valve schedule for the entire project.

3.2.5 Damper Schedule

Provide a damper schedule containing each damper's unique identifier, type (opposed or parallel blade), nominal and actual sizes, orientation of axis and frame, direction of blade rotation, actuator size and spring ranges, operation rate, positive positioner range, location of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. Include the AMCA 511 maximum leakage rate at the operating static-pressure differential for each damper in the Damper Schedule. Provide a single damper schedule for the entire project.

3.2.6 Project Summary Equipment Schedule

Provide a project summary equipment schedule containing the manufacturer, model number, part number and descriptive name for each control device, hardware and component provided under this specification. Provide a single project equipment schedule for the entire project.

3.2.7 Equipment Schedule

Provide system equipment schedules containing the unique identifier, manufacturer, model number, part number and descriptive name for each control device, hardware and component provided under this specification. Provide a separate equipment schedule for each HVAC system.

3.2.8 Occupancy Schedule

Provide an occupancy schedule drawing containing the same fields as the occupancy schedule Contract Drawing with Contractor updated information. Provide a single occupancy schedule for the entire project.

3.2.9 DDC Hardware Schedule

Provide a single DDC Hardware Schedule for the entire project and including following information for each device.

3.2.9.1 DDC Hardware Identifier

The Unique DDC Hardware Identifier for the device.

3.2.9.2 HVAC System

The system "name" used to identify a specific system (the name used on the system schematic drawing for that system).

3.2.9.3 BACnet Device Information

3.2.9.3.1 Device Object Identifier

The Device Object Identifier: The Object_Identifier of the Device Object.

3.2.9.3.2 Network Number

The Network Number for the device.

3.2.9.3.3 MAC Address

The MAC Address for the device.

3.2.9.3.4 BTL Listing

The BTL Listing of the device. If the device is listed under multiple BTL Profiles, indicate the profile that matches the use and configuration of the device as installed.

3.2.9.3.5 Proprietary Services Information

If the device uses non-standard ASHRAE 135 services as defined and permitted in Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS, indicate that the device uses non-standard services and include a description of all non-standard services used. Describe usage and content such that a device from another vendor can interoperate with the device using the non-standard service. Provide descriptions with sufficient detail to allow a device from a different manufacturer to be programmed to both read and write the non-standard service request:

a. Read: Interpret the data contained in the non-standard service and;

b. Write: Given similar data, generate the appropriate non-standard service request.

3.2.9.3.6 Alarming Information

Indicate whether the device is used for alarm generation, and which types of alarm generation the device implements: Intrinsic, local algorithmic, remote algorithmic.

3.2.9.3.7 Scheduling Information

Indicate whether the device is used for scheduling.

3.2.9.3.8 Trending Information

Indicate whether the device is used for trending, and indicate if the device is used to trend local values, remote values, or both.

3.2.10 Points Schedule

Provide a Points Schedule in tabular form for each HVAC system, with the indicated columns and with each row representing a hardware point, network point or configuration point in the system.

a. When a Points Schedule was included in the Contract Drawing package, use the same fields as the Contract Drawing with updated information in addition to the indicated fields.

b. When Point Schedules are included in the contract package, items requiring Contractor verification or input have been shown in angle brackets ("<" and ">"), such as <___> for a required entry or <value> for a value requiring confirmation. Complete all items in brackets as well as any blank cells. Do not modify values which are not in brackets without approval.

Points Schedule Columns must include:

3.2.10.1 Point Name

The abbreviated name for the point using the indicated naming convention.

3.2.10.2 Description

A brief functional description of the point such as "Supply Air Temperature".

3.2.10.3 DDC Hardware Identifier

The Unique DDC Hardware Identifier shown on the DDC Hardware Schedule and used across all drawings for the DDC Hardware containing the point.

3.2.10.4 Settings

The value and units of any setpoints, configured setpoints, configuration parameters, and settings related to each point.

3.2.10.5 Range

The range of values, including units, associated with the point, including but not limited to a zone temperature setpoint adjustment range, a sensor measurement range, occupancy values for an occupancy input, or the status of a safety.

3.2.10.6 Input or Output (I/O) Type

The type of input or output signal associated with the point. Use the following abbreviations for entries in this column:

a. AI: The value comes from a hardware (physical) Analog Input.

b. AO: The value is output as a hardware (physical) Analog Output.

c. BI: The value comes from a hardware (physical) Binary Input.

d. BO: The value is output as a hardware (physical) Binary Output.

e. PULSE: The value comes from a hardware (physical) Pulse Accumulator Input.

f. NET-IN: The value is provided from the network (generally from another device). Use this entry only when the value is received from another device as part of scheduling or as part of a sequence of operation, not when the value is received on the network for

supervisory functions such as trending, alarming, override or display at a user interface.

g. NET-OUT: The value is provided to another controller over the network. Use this entry only when the value is transmitted to another device as part of scheduling or as part of a sequence of operation, not when the value is transmitted on the network for supervisory functions such as trending, alarming, override or display at a user interface.

3.2.10.7 Object and Property Information

The Object Type and Instance Number for the Object associated with the point. If the value of the point is not in the Present_Value Property, then also provide the Property ID for the Property containing the value of the point. Any point that is displayed at the front end or on an LDP, is trended, is used by another device on the network, or has an alarm condition must be documented here.

3.2.10.8 Network Data Exchange Information (Gets Data From, Sends Data To)

Provide the DDC Hardware Identifier of other DDC Hardware the point is shared with.

3.2.10.9 Override Information (Object Type and Instance Number)

For each point requiring an Override, indicate if the Object for the point is Commandable or, if the use of a separate Object was specifically approved by the Contracting Officer, provide the Object Type and Instance Number of the Object to be used in overriding the point.

3.2.10.10 Trend Object Information

For each point requiring a trend, indicate if the trend is Local or Remote, the trend Object type and the trend Object instance number. For remote trends provide the DDC Hardware Identifier for the device containing the trend Object in the Points Schedule notes.

3.2.10.11 Alarm Information

Indicate the Alarm Generation Type, Event Enrollment Object Instance Number, and Notification Class Object Instance Number for each point requiring an alarm. (Note that not all alarms will have Event Enrollment Objects.)

3.2.10.12 Configuration Information

Indicate the means of configuration associated with each point.

a. For Operator Configurable Points indicate BACnet Object and Property information (Name, Type, Identifiers) containing the configurable value. Indicate whether the property is writable always, or only when Out_Of_Service is TRUE.

b. For Configurable Points indicate the BACnet Object and Property information as for Operator Configurable points, or identification of the configurable settings from within the engineering software for the device or identification of the hardware settings on the device.

3.2.11 Riser Diagram

The Riser Diagram of the Building Control Network may be in tabular form, and must show all DDC Hardware and all Network Hardware, including network terminators. For each item, provide the unique identifier, common descriptive name, physical sequential order (previous and next device on the network), room identifier and location within room. A single riser diagram must be submitted for the entire system.

3.2.12 Control System Schematics

Provide control system schematics in the same form as the control system schematic Contract Drawing with Contractor updated information. Provide a control system schematic for each HVAC system.

3.2.13 Sequences of Operation Including Control Logic Diagrams

Provide HVAC control system sequence of operation and control logic diagrams in the same format as the Contract Drawings. Within these drawings, refer to devices by their unique identifiers. Submit sequences of operation and control logic diagrams for each HVAC system.

3.2.14 Controller, Motor Starter and Relay Wiring Diagram

Provide controller wiring diagrams as functional wiring diagrams which show the interconnection of conductors and cables to each controller and to the identified terminals of input and output devices, starters and package equipment. Show necessary jumpers and ground connections and the labels of all conductors. Identify sources of power required for control systems and for packaged equipment control systems back to the panel board circuit breaker number, controller enclosures, magnetic starter, or packaged equipment control circuit. Show each power supply and transformer not integral to a controller, starter, or packaged equipment. Show the connected volt-ampere load and the power supply volt-ampere rating. Provide wiring diagrams for each HVAC system.

3.3 CONTROLLER TUNING

Tune each controller in a manner consistent with that described in the ASHRAE FUN IP and in the manufacturer's instruction manual. Tuning must consist of adjustment of the proportional, integral, and where applicable, the derivative (PID) settings to provide stable closed-loop control. Each loop must be tuned while the system or plant is operating at a high gain (worst case) condition, where high gain can generally be defined as a low-flow or low-load condition. Upon final adjustment of the PID settings, in response to a change in controller setpoint, the controlled variable must settle out at the new setpoint with no more than two (2) oscillations above and below setpoint. Upon settling out at the new setpoint the controller output must be steady. With the exception of naturally slow processes such as zone temperature control, the controller must settle out at the new setpoint within five (5) minutes. Set the controller to its correct setpoint and record and submit the final PID configuration settings with the O&M Instructions and on the associated Points Schedule.

3.4 START-UP

3.4.1 Start-Up Test

Perform the following startup tests for each control system to ensure that the described control system components are installed and functioning per this specification.

Adjust, calibrate, measure, program, configure, set the time schedules, and otherwise perform all necessary actions to ensure that the systems function as indicated and shown in the sequence of operation and other contract documents.

3.4.1.1 Systems Check

An item-by-item check must be performed for each HVAC system.

3.4.1.1.1 Step 1 - System Inspection

With the system in unoccupied mode and with fan hand-off-auto switches in the OFF position, verify that power and main air are available where required and that all output devices are in their failsafe and normal positions. Inspect each local display panel to verify that all displays indicate shutdown conditions.

3.4.1.1.2 Step 2 - Calibration Accuracy Check

Perform a two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter by comparing the value from the test instrument to the network value provided by the DDC Hardware. Use digital indicating test instruments, such as digital thermometers, motor-driven psychrometers, and tachometers. Use test instruments with accuracy at least twice as accurate as the specified sensor accuracy and with calibration traceable to National Institute of Standards and Technology standards. Check one the first check point in the bottom one-third of the sensor range, and the second in the top one-third of the sensor range. Verify that the sensing element-to-DDC readout accuracies at two points are within the specified product accuracy tolerances, and if not recalibrate or replace the device and repeat the calibration check.

3.4.1.1.3 Step 3 - Actuator Range Check

With the system running, apply a signal to each actuator through the DDC Hardware controller. Verify proper operation of the actuators and positioners for all actuated devices and record the signal levels for the extreme positions of each device. Vary the signal over its full range, and verify that the actuators travel from zero stroke to full stroke within the signal range. Where applicable, verify that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. For valve actuators and damper actuators, perform the actuator range check under normal system pressures.

3.4.1.2 Weather Dependent Test

Perform weather dependent test procedures in the appropriate climatic season.

3.4.2 Start-Up Testing Report

Submit 4 copies of the Start-Up Testing Report. The report may be submitted as a Technical Data Package documenting the results of the tests performed and certifying that the system is installed and functioning per this specification, and is ready for the Performance Verification Test (PVT).

3.5 PERFORMANCE VERIFICATION TEST (PVT)

3.5.1 PVT Procedures

Prepare PVT Procedures explaining step-by-step, the actions and expected results that will demonstrate that the control system performs in accordance with the sequences of operation, and other contract documents. Submit 4 copies of the PVT Procedures. The PVT Procedures may be submitted as a Technical Data Package. All PVT reports shall be submitted prior to commissioning functional testing.

3.5.1.1 Sensor Accuracy Checks

Include a one-point accuracy check of each sensor in the PVT procedures.

3.5.1.2 Endurance Test

Include a one-week endurance test as part of the PVT during which the system is operated continuously.

Use the building control system BACnet Trend Log or Trend Log Multiple Objects to trend all points shown as requiring a trend on the Point Schedule for the entire endurance test. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost.

3.5.1.3 PVT Equipment List

Include in the PVT procedures a control system performance verification test equipment list that lists the equipment to be used during performance verification testing. For each piece of equipment, include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

3.5.2 PVT Execution

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures approved by the Government, software capable of reading and writing COV Notification Subscriptions, Notification Class Recipient List Properties, event enrollments, demonstrate all physical and functional requirements of the project. Show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. Do not start the performance verification test until after receipt of written permission by the Government, based on Government approval of the PVT Plan and Draft As-Builts and completion of balancing. UNLESS GOVERNMENT WITNESSING OF A TEST IS SPECIFICALLY WAIVED BY THE GOVERNMENT, PERFORM ALL TESTS WITH A GOVERNMENT WITNESS. Do not conduct tests during scheduled seasonal off periods of base heating and cooling systems. If the system experiences any failures during the endurance test portion of the PVT, repair the system repeat the endurance test portion of the PVT until the

system operates continuously and without failure for the specified endurance test period.

3.5.3 PVT Report

Prepare and submit a PVT report documenting all tests performed during the PVT and their results. Include all tests in the PVT procedures and any additional tests performed during PVT. Document test failures and repairs conducted with the test results.

Submit four copies of the PVT Report. The PVT Report may be submitted as a Technical Data Package.

3.6 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Provide HVAC control System Operation and Maintenance Instructions which include:

a. "Data Package 3" as indicated in Section 01 78 23 OPERATION AND MAINTENANCE DATA for each piece of control equipment.

b. "Data Package 4" as described in Section 01 78 23 OPERATION AND MAINTENANCE DATA for all air compressors.

c. HVAC control system sequences of operation formatted as indicated.

d. Procedures for the HVAC system start-up, operation and shut-down including the manufacturer's supplied procedures for each piece of equipment, and procedures for the overall HVAC system.

e. As-built HVAC control system detail drawings formatted as indicated.

f. Routine maintenance checklist. Provide the routine maintenance checklist arranged in a columnar format, where the first column lists all installed devices, the second column states the maintenance activity or that no maintenance required, the third column states the frequency of the maintenance activity, and the fourth column is used for additional comments or reference.

g. Qualified service organization list, including at a minimum company name, contact name and phone number.

h. Start-Up Testing Report.

i. Performance Verification Test (PVT) Procedures and Report.

Submit 2 copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions may be submitted as a Technical Data Package.

3.7 MAINTENANCE AND SERVICE

Provide services, materials and equipment as necessary to maintain the entire system in an operational state as indicated for a period of one year after successful completion and acceptance of the Performance Verification Test. Minimize impacts on facility operations.

a. The integration of the system specified in this section into a Utility Monitoring and Control System must not, of itself, void the warranty

or otherwise alter the requirement for the one year maintenance and service period. Integration into a EMCS includes but is not limited to establishing communication between devices in the control system and the front end or devices in another system.

b. The changing of configuration properties must not, of itself, void the warranty or otherwise alter the requirement for the one year maintenance and service period.

c. The use of Government-owned assets (e.g., computer, tablet) for control systems maintenance is required. Any connection of removable media to a control system or control systems network enclave is prohibited.

3.7.1 Description of Work

Provide adjustment and repair of the system including the manufacturer's required sensor and actuator (including transducer) calibration, span and range adjustment.

3.7.2 Personnel

Use only service personnel qualified to accomplish work promptly and satisfactorily. Advise the Government in writing of the name of the designated service representative, and of any changes in personnel.

3.7.3 Scheduled Inspections

Perform two inspections at six-month intervals and provide work required. Perform inspections in June and December. During each inspection perform the indicated tasks:

a. Perform visual checks and operational tests of equipment.

b. Clean control system equipment including interior and exterior surfaces.

c. Check and calibrate each field device. Check and calibrate 50 percent of the total analog inputs and outputs during the first inspection. Check and calibrate the remaining 50 percent of the analog inputs and outputs during the second major inspection. Certify analog test instrumentation accuracy to be twice the specified accuracy of the device being calibrated. Randomly check at least 25 percent of all binary inputs and outputs for proper operation during the first inspection. Randomly check at least 25 percent of the remaining binary inputs and outputs during the second inspection. If more than 20 percent of checked inputs or outputs failed the calibration check during any inspection, check and recalibrate all inputs and outputs during that inspection.

d. Run system software diagnostics and correct diagnosed problems.

e. Resolve any previous outstanding problems.

3.7.4 Scheduled Work

This work must be performed during regular working hours, Monday through Friday, excluding Federal holidays.

3.7.5 Emergency Service

The Government will initiate service calls when the system is not functioning properly. Qualified personnel must be available to provide service to the system. A telephone number where the service supervisor can be reached at all times must be provided. Service personnel must be at the site within 24 hours after receiving a request for service.

3.7.6 Operation

After performing scheduled adjustments and repairs, verify control system operation as demonstrated by the applicable tests of the performance verification test.

3.7.7 Records and Logs

Keep dated records and logs of each task, with cumulative records for each major component, and for the complete system chronologically. Maintain a continuous log for all devices, including initial analog span and zero calibration values and digital points. Keep complete logs and provide logs for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

3.7.8 Work Requests

Record each service call request as received and include its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. Submit a record of the work performed within 5 days after work is accomplished.

3.7.9 System Modifications

Submit recommendations for system modification in writing. Do not make system modifications, including operating parameters and control settings, without prior approval of the Government.

3.8 TRAINING

Conduct a training course for operating staff members designated by the Government in the maintenance and operation of the system, including specified hardware and software. Conduct 32 hours of training at the project site within 30 days after successful completion of the performance verification test. The Government reserves the right to make audio and visual recordings (using Government supplied equipment)of the training sessions for later use. Provide audiovisual equipment and other training materials and supplies required to conduct training. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.8.1 Training Documentation

Prepare training documentation consisting of:

a. Course Attendee List: Develop the list of course attendees in coordination with and signed by the Controls HVAC shop supervisor.

b. Training Manuals: Provide training manuals which include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. When presenting portions of the course material by audiovisuals, deliver copies of those audiovisuals as a part of the printed training manuals.

3.8.2 Training Course Content

For guidance in planning the required instruction, assume that attendees will have a high school education, and are familiar with HVAC systems. During the training course, cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each controller enclosure, the layout of one of each type of equipment and the locations of each, the location of each control device external to the panels, the location of the compressed air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. Present the results of the performance verification test and the Start-Up Testing Report as benchmarks of HVAC control system performance by which to measure operation and maintenance effectiveness.

3.8.3 Training Documentation Submittal Requirements

Submit hardcopy training manuals and all training materials on CD-ROM. Provide one hardcopy manual for each trainee on the Course Attendee List and 2 additional copies for archive at the project site. Provide 2 copies of the Course Attendee List with the archival copies. Training Documentation may be submitted as a Technical Data Package.

APPENDIX A

QC CHECKLIST FOR BACNET SYSTEMS		
This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such. Instructions: Initial each item in the space provided (|____|) verifying that the requirement has been met.		
This checklist is for (circle one:) Pre-Construction QC Checklist Submittal Post-Construction QC Checklist Submittal Close-out QC Checklist Submittal		
Items verified for Pre-Construction, Post-Construction and Closeout QC Checklist Submittals:		
1	All DDC Hardware is numbered on Control System Schematic Drawings.	|____|
2	Signal lines on Control System Schematic are labeled with the signal type.	|____|
3	Local Display Panel (LDP) Locations are shown on Control System Schematic drawings.	|____|
Items verified for Post-Construction and Closeout QC Checklist Submittals:		
4	All sequences are performed as specified using DDC Hardware.	|____|
5	Training schedule and course attendee list has been developed and coordinated with shops and submitted.	|____|
Items verified for Closeout QC Checklist Submittal:		
6	Final As-built Drawings, including all Points Schedule drawings, accurately represent the final installed system.	|____|
7	Programming software has been submitted for all programmable controllers.	|____|
8	All software has been licensed to the Government.	
9	O&M Instructions have been completed and submitted.	|____|
10	Training course has been completed.	|____|

QC CHECKLIST FOR BACNET SYSTEMS		
11	All DDC Hardware is installed on a BACnet ASHRAE 135 network using either MS/TP in accordance with Clause 9 or IP in accordance with Annex J.	|_____|
12	All DDC Hardware is BTL listed.	|_____|
13	Communication between DDC Hardware is only via BACnet using standard services, except as specifically permitted by the specification. Non-standard services have been fully documented in the DDC Hardware Schedule.	|_____|
14	Scheduling, Alarming, and Trending have been implemented using the standard BACnet Objects for these functions.	|_____|
15	All Properties indicated as required to be Writable are Writable and Overrides have been provided as indicated	|_____|
	_____ _____	
	(QC Representative Signature) (Date)	

-- End of Section --

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SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC
11/15

PART 1 GENERAL

1.1 SUMMARY

This section provides for the instrumentation control system components excluding direct digital controllers, network controllers, gateways etc. that are necessary for a completely functional automatic control system. When combined with a Direct Digital Control (DDC) system, the Instrumentation and Control Devices covered under this section must be a complete system suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and indicated.

a. Install hardware to perform the control sequences as specified and indicated and to provide control of the equipment as specified and indicated.

b. Install hardware such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

c. Install and configure hardware such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the installing Contractor.

1.1.1 Verification of Dimensions

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.1.2 Drawings

The Government will not indicate all offsets, fittings, and accessories that may be required on the drawings. Carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, arrange such work accordingly, and provide all work necessary to meet such conditions.

1.2 RELATED SECTIONS

Related work specified elsewhere.

Section 23 30 00 HVAC AIR DISTRIBUTION

Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

1.3 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 MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 500-D	(2018) Laboratory Methods of Testing Dampers for Rating
AMCA 511	(2010) Certified Ratings Program for Air Control Devices

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.15	(2018) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.34	(2017) Valves - Flanged, Threaded and Welding End

ASTM INTERNATIONAL (ASTM)

ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings

FLUID CONTROLS INSTITUTE (FCI)

FCI 70-2	(2013) Control Valve Seat Leakage

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 5085-3	(2006; Reprint Nov 20121) Low Voltage Transformers - Part 3: Class 2 and Class 3 Transformers

1.4 SUBMITTALS

Submittal requirements are specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Submit calibration certificates for all VOC and CO sensors installed on project.

1.5 DELIVERY AND STORAGE

Store and protect products from the weather, humidity, and temperature variations, dirt and dust, and other contaminants, within the storage

condition limits published by the equipment manufacturer.

1.6 INPUT MEASUREMENT ACCURACY

Select, install and configure sensors, transmitters and DDC Hardware such that the maximum error of the measured value at the input of the DDC hardware is less than the maximum allowable error specified for the sensor or instrumentation.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 General Requirements

All products used to meet this specification must meet the indicated requirements, but not all products specified here will be required by every project. All products must meet the requirements both Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and this Section.

2.1.2 Operation Environment Requirements

Unless otherwise specified, provide products rated for continuous operation under the following conditions:

2.1.2.1 Pressure

Pressure conditions normally encountered in the installed location.

2.1.2.2 Vibration

Vibration conditions normally encountered in the installed location.

2.1.2.3 Temperature

a. Products installed indoors: Ambient temperatures in the range of 32 to 112 degrees F and temperature conditions outside this range normally encountered at the installed location.

b. Products installed outdoors or in unconditioned indoor spaces: Ambient temperatures in the range of minus 35 to plus 151 degrees F and temperature conditions outside this range normally encountered at the installed location.

2.1.2.4 Humidity

10 to 95 percent relative humidity, non-condensing and also humidity conditions outside this range normally encountered at the installed location.

2.2 WEATHERSHIELDS

Provide weathershields constructed of galvanized steel painted white, unpainted aluminum, aluminum painted white, or white PVC.

2.3 WIRE AND CABLE

Provide wire and cable meeting the requirements of NFPA 70 and NFPA 90A in addition to the requirements of this specification and referenced

specifications.

2.3.1 Terminal Blocks

For terminal blocks which are not integral to other equipment, provide terminal blocks which are insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, suitable for DIN rail mounting, and which have enclosed sides or end plates and partition plates for separation.

2.3.2 Control Wiring for Binary Signals

For Control Wiring for Binary Signals, provide 18 AWG copper or thicker wire rated for 300-volt service.

2.3.3 Control Wiring for Analog Signals

For Control Wiring for Analog Signals, provide 18 AWG or thicker, copper, single- or multiple-twisted wire meeting the following requirements:

a. Minimum 2 inch lay of twist.

b. 100 percent shielded pairs.

c. At least 300-volt insulation.

d. Each pair has a 20 AWG tinned-copper drain wire and individual overall pair insulation.

e. Cables have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.3.4 Power Wiring for Control Devices

For 24-volt circuits, provide insulated copper 18 AWG or thicker wire rated for 300 VAC service. For 120-volt circuits, provide 14 AWG or thicker stranded copper wire rated for 600-volt service.

2.3.5 Transformers

Provide UL 5085-3 approved transformers. Select transformers sized so that the connected load is no greater than 80 percent of the transformer rated capacity.

2.4 AUTOMATIC CONTROL VALVES

Provide valves with stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Provide valves with bodies meeting ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure. Unless otherwise specified or indicated, provide valves meeting FCI 70-2 Class III leakage rating. Provide valves rated for modulating or two-position service as indicated, which close against a differential pressure indicated as the Close-Off pressure and which are Normally-Open, Normally-Closed, or Fail-In-Last-Position as indicated. Valves shall be compatible with 35 percent propylene glycol.

2.4.1 Valve Type

2.4.1.1 Liquid Service 150 Degrees F or Less

Use either globe valves or ball valves except that butterfly valves may be used for sizes 4 inch and larger.

2.4.2 Valve Flow Coefficient and Flow Characteristic

2.4.2.1 Two-Way Modulating Valves

Provide the valve coefficient (Cv) indicated. Provide equal-percentage flow characteristic for liquid service except for butterfly valves.

2.4.2.2 Three-Way Modulating Valves

Provide the valve coefficient (Cv) indicated. Provide linear flow characteristic with constant total flow throughout full plug travel.

2.4.3 Two-Position Valves

Use full line size full port valves with maximum available (Cv).

2.4.4 Globe Valves

2.4.4.1 Liquid Service Not Exceeding 150 Degrees F

a. Valve body and body connections:

(1) Valves 1-1/2 inches and smaller: Brass or bronze body, with threaded or union ends.

(2) Valves from 2 inches to 3 inches inclusive: Brass, bronze, or iron bodies. 2 inch valves with threaded connections; 2-1/2 to 3 inches valves with flanged connections.

b. Internal valve trim: Brass or bronze.

c. Stems: Stainless steel.

d. Provide valves compatible with a solution of 50 percent ethylene or propylene glycol.

2.4.5 Ball Valves

2.4.5.1 Liquid Service Not Exceeding 150 Degrees F

a. Valve body and connections:

(1) Valves 1-1/2 inches and smaller: Bodies of brass or bronze, with threaded or union ends.

(2) Valves from 2 inches to 3 inches inclusive: Bodies of brass, bronze, or iron. 2 inch valves with threaded connections; valves from 2-1/2 to 3 inches with flanged connections.

b. Ball: Stainless steel.

c. Seals: Reinforced Teflon seals and EPDM O-rings.

d. Stem: Stainless steel, blow-out proof.

e. Provide valves compatible with a solution of 35 percent propylene glycol.

2.4.6 Butterfly Valves

Provide butterfly valves which are threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies or with ductile iron bodies in accordance with ASTM A536. Provide butterfly valves with non-corrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to plus 250 degrees F. Provide valves with rated Cv of the Cv at 70 percent (60 degrees) open position. Provide valves meeting FCI 70-2 Class VI leakage rating.

2.5 DAMPERS

2.5.1 Damper Assembly

Provide single damper sections with blades no longer than 48 inches and which are no higher than 72 inches and damper blade width of 8 inches or less. When larger sizes are required, combine damper sections. Provide dampers made of aluminum, galvanized steel, or other materials where indicated and with assembly frames constructed of 0.07 inch minimum thickness aluminum or galvanized steel channels with mitered and welded corners. Steel channel frames constructed of 0.06 inch minimum thickness are acceptable provided the corners are reinforced.

a. Blades shall be maximum 6 inches deep extruded air-foil profiles. All blades are symmetrically pivoted. Proved end caps on blade ends. Provide silicone blade and frame seals.

b. Blade-operating linkages must be within the frame so that blade-connecting devices within the same damper section must not be located directly in the air stream.

c. Damper axles must be 1/2 inch minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically must be supported by thrust bearings.

d. Provide dampers which do not exceed a pressure drop through the damper of 0.04 inches water gauge at 1,000 ft/min in the wide-open position. Provide dampers with frames not less than 2 inch in width. Provide dampers which have been tested in accordance with AMCA 500-D.

e. Unless otherwise indicated, dampers must meet AMCA 511 Class 1A (3 cfm per sq foot of damper face area at 1.0 inches water gauge static pressure) requirements. Outside air damper seals must be suitable for an operating temperature range of minus 40 to plus 167 degrees F. Dampers must be rated at not less than 2,000 ft/min air velocity.

f. Where insulated dampers are indicated, provide internally insulated airfoil blades with expanded polyurethane foam and thermal break.

2.5.2 Operating Linkages

For operating links external to dampers, such as crank arms, connecting

rods, and line shafting for transmitting motion from damper actuators to dampers, provide links able to withstand a load equal to at least 300 percent of the maximum required damper-operating force without deforming. Rod lengths must be adjustable. Links must be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises must be brass, bronze, or stainless steel. Adjustments of crank arms must control the open and closed positions of dampers.

2.5.3 Damper Types

2.5.3.1 Flow Control Dampers

Provide parallel-blade or opposed blade type dampers for outside air, return air, relief air, exhaust, dampers as indicated on the Damper Schedule. Blades must have interlocking edges. For outside air and exhaust air dampers, blade seals shall be silicone. The channel frames of the dampers must be provided with jamb seals to minimize air leakage. Unless otherwise indicated, dampers must meet AMCA 511 Class 1A requirements. Outside air damper seals must be suitable for an operating temperature range of minus 40 to plus 167 degrees F. Dampers must be rated at not less than 2,000 ft/min air velocity.

2.5.3.2 Mechanical Rooms and Other Utility Space Ventilation Dampers

Provide utility space ventilation dampers as indicated. Unless otherwise indicated provide AMCA 511 class 1 dampers. Provide dampers rated at not less than 1,500 ft/min air velocity.

2.6 SENSORS AND INSTRUMENTATION

Unless otherwise specified, provide sensors and instrumentation which incorporate an integral transmitter. Sensors and instrumentation, including their transmitters, must meet the specified accuracy and drift requirements at the input of the connected DDC Hardware's analog-to-digital conversion.

2.6.1 Analog and Binary Transmitters

Provide transmitters which match the characteristics of the sensor. Transmitters providing analog values must produce a linear 4-20 mAdc, 0-10 Vdc signal corresponding to the required operating range and must have zero and span adjustment. Transmitters providing binary values must have dry contacts rated at 1A at 24 Volts AC.

2.6.2 Network Transmitters

Sensors and Instrumentation incorporating an integral network connection are considered DDC Hardware and must meet the DDC Hardware requirements of Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

2.6.3 Temperature Sensors

Provide the same sensor type throughout the project. Temperature sensors may be provided without transmitters. Where transmitters are used, the range must be the smallest available from the manufacturer and suitable for the application such that the range encompasses the expected range of temperatures to be measured. The end to end accuracy includes the combined effect of sensitivity, hysteresis, linearity and repeatability

between the measured variable and the end user interface (graphic presentation) including transmitters if used.

2.6.3.1 Sensor Accuracy and Stability of Control

2.6.3.1.1 Conditioned Space Temperature

Plus or minus 0.5 degree F over the operating range.

2.6.3.1.2 Unconditioned Space Temperature

a. Plus or minus 1 degree F over the range of 30 to 131 degrees F AND

b. Plus or minus 4 degrees F over the rest of the operating range.

2.6.3.1.3 Duct Temperature

Plus or minus 0.5 degree F

2.6.3.1.4 Outside Air Temperature

a. Plus or minus 2 degrees F over the range of minus 30 to plus 130 degrees F AND

b. Plus or minus 1 degree F over the range of 30 to 130 degrees F.

2.6.3.1.5 Chilled Water

Plus or minus 0.8 degrees F over the range of 35 to 65 degrees F.

2.6.3.1.6 Heating Hot Water

Plus or minus 2 degrees F.

2.6.3.2 Transmitter Drift

The maximum allowable transmitter drift: 0.25 degrees F per year.

2.6.3.3 Point Temperature Sensors

Point Sensors must be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper.

2.6.3.4 Temperature Sensor Details

2.6.3.4.1 Room Type

Provide the sensing element components within a decorative protective cover suitable for surrounding decor.

2.6.3.4.2 Duct Probe Type

Ensure the probe is long enough to properly sense the air stream temperature.

2.6.3.4.3 Duct Averaging Type

Continuous averaging sensors must be one foot in length for each 1 square foot of duct cross-sectional area, and a minimum length of 5 feet.

2.6.3.4.4 Pipe Immersion Type

Provide minimum 3 inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells must be stainless steel when used in steel piping, and brass when used in copper piping.

2.6.3.4.5 Outside Air Type

Provide the sensing element rated for outdoor use

2.6.4 Relative Humidity Sensor

Relative humidity sensors must use bulk polymer resistive or thin film capacitive type non-saturating sensing elements capable of withstanding a saturated condition without permanently affecting calibration or sustaining damage. The sensors must include removable protective membrane filters. Where required for exterior installation, sensors must be capable of surviving below freezing temperatures and direct contact with moisture without affecting sensor calibration. When used indoors, the sensor must be capable of being exposed to a condensing air stream (100 percent relative humidity) with no adverse effect to the sensor's calibration or other harm to the instrument. The sensor must be of the wall-mounted or duct-mounted type, as required by the application, and must be provided with any required accessories. Sensors used in duct high-limit applications must have a bulk polymer resistive sensing element. Duct-mounted sensors must be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. Relative humidity (RH) sensors must measure relative humidity over a range of 0 percent to 100 percent with an accuracy of plus or minus 3 percent. RH sensors must function over a temperature range of 40 to 135 degrees F and must not drift more than 1 percent per year.

2.6.5 Carbon Dioxide (CO2) Sensors

Provide photometric type CO2 sensors with integral transducers and linear output. Carbon dioxide (CO2) sensors must measure CO2 concentrations between 0 to 2,000 parts per million (ppm) using non-dispersible infrared (NDIR) technology with an accuracy of plus or minus 50 ppm and a maximum response time of 1 minute. The sensor must be rated for operation at ambient air temperatures within the range of 32 to 122 degrees F and relative humidity within the range of 20 to 95 percent (non-condensing). The sensor must have a maximum drift of 2 percent per year. The sensor chamber must be manufactured with a non-corrosive material that does not affect carbon dioxide sample concentration. Duct mounted sensors must be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. The sensor must have a calibration interval no less than 5 years.

2.6.6 Differential Pressure Instrumentation

2.6.6.1 Differential Pressure Sensors

Provide Differential Pressure Sensors with ranges as indicated or as required for the application. Pressure sensor ranges must not exceed the high end range indicated on the Points Schedule by more than 50 percent. The over pressure rating must be a minimum of 150 percent of the highest design pressure of either input to the sensor. The accuracy must be plus

or minus 1 percent of full scale. The sensor must have a maximum drift of 2 percent per year.

2.6.6.2 Differential Pressure Switch

Provide differential pressure switches with a user-adjustable setpoint which are sized for the application such that the setpoint is between 25 percent and 75 percent of the full range. The over pressure rating must be a minimum of 150 percent of the highest design pressure of either input to the sensor. The switch must have two sets of contacts and each contact must have a rating greater than it's connected load. Contacts must open or close upon rise of pressure above the setpoint or drop of pressure below the setpoint as indicated.

2.6.7 Flow Sensors

2.6.7.1 Airflow Measurement Array (AFMA)

2.6.7.1.1 Airflow Straightener

Provide AFMAs which contain an airflow straightener if required by the AFMA manufacturer's published installation instructions. The straightener must be contained inside a flanged sheet metal casing, with the AFMA located as specified according to the published recommendation of the AFMA manufacturer. In the absence of published documentation, provide airflow straighteners if there is any duct obstruction within 5 duct diameters upstream of the AFMA. Air-flow straighteners, where required, must be constructed of 0.125 inch aluminum honeycomb and the depth of the straightener must not be less than 1.5 inches.

2.6.7.1.2 Resistance to Airflow

The resistance to air flow through the AFMA, including the airflow straightener must not exceed 0.085 inch water gauge at an airflow of 2,000 fpm. AFMA construction must be suitable for operation at airflows of up to 5,000 fpm over a temperature range of 40 to 120 degrees F.

2.6.7.1.3 Pitot Tube AFMA

Each Pitot Tube AFMA must contain an array of velocity sensing elements. The velocity sensing elements must be of the multiple pitot tube type with averaging manifolds. The sensing elements must be distributed across the duct cross section in the quantity and pattern specified or recommended by the published installation instructions of the AFMA manufacturer.

a. Pitot Tube AFMAs for use in airflows over 600 fpm must have an accuracy of plus or minus 5 percent over a range of 500 to 2,500 fpm.

b. Pitot Tube AFMAs for use in airflows under 600 fpm must have an accuracy of plus or minus 5 percent over a range of 125 to 2,500 fpm.

2.6.7.1.4 Electronic AFMA

Each electronic AFMA must consist of an array of velocity sensing elements of the resistance temperature detector (RTD) or thermistor type. The sensing elements must be distributed across the duct cross section in the quantity and pattern specified or recommended by the published application data of the AFMA manufacturer. Electronic AFMAs must have an accuracy of plus or minus 5 percent over a range of 125 to 5,000 fpm and the output

must be temperature compensated over a range of 32 to 212 degrees F.

2.6.7.1.5 Fan Inlet Measurement Devices

Fan inlet measurement devices cannot be used unless indicated on the drawings or schedules.

2.6.7.2 Annular Pitot Tube

Annular pitot tube must be made of austenitic stainless steel with an accuracy of plus or minus 2 percent of full flow and a repeatability of plus or minus 0.5 percent of measured value. The unit must have at least one static port and no less than four total head pressure ports with an averaging manifold.

2.6.7.3 Flow Switch

Flow switch must have a repetitive accuracy of plus or minus 10 percent of actual flow setting. Switch actuation must be adjustable over the operating flow range, and must be sized for the application such that the setpoint is between 25 percent and 75 percent of the full range. The switch must have Form C snap-action contacts, rated for the application. The flow switch must have non flexible paddle with magnetically actuated contacts and be rated for service at a pressure greater than the installed conditions. Flow switch for use in sewage system must be rated for use in corrosive environments encountered.

2.6.8 Electrical Instruments

Provide Electrical Instruments with an input range as indicated or sized for the application. Unless otherwise specified, AC instrumentation must be suitable for 60 Hz operation.

2.6.8.1 Current Transducers

Current transducers must accept an AC current input and must have an accuracy of plus or minus 2 percent of full scale. The device must have a means for calibration. Current transducers for variable frequency applications must be rated for variable frequency operation.

2.6.8.2 Current Sensing Relays (CSRs)

Current sensing relays (CSRs) must provide a normally-open contact with a voltage and amperage rating greater than its connected load. Current sensing relays must be of split-core design. The CSR must be rated for operation at 200 percent of the connected load. Voltage isolation must be a minimum of 600 volts. The CSR must auto-calibrate to the connected load or be adjustable and field calibrated. Current sensors for variable frequency applications must be rated for variable frequency operation.

2.6.8.3 Voltage Transducers

Voltage transducers must accept an AC voltage input and have an accuracy of plus or minus 0.25 percent of full scale. The device must have a means for calibration. Line side fuses for transducer protection must be provided.

2.6.9 Occupancy Sensors

Occupancy sensors are specified in Division 26.

2.6.10 Floor Mounted Leak Detector

Leak detectors must use electrodes mounted at slab level with a minimum built-in-vertical adjustment of 0.125 inches. Detector must have a binary output. The indicator must be manual reset type.

2.6.11 Temperature Switch

2.6.11.1 Duct Mount Temperature Low Limit Safety Switch (Freezestat)

Duct mount temperature low limit switches (Freezestats) must be manual reset, low temperature safety switches at least 1 foot long per square foot of coverage which must respond to the coldest 18 inch segment with an accuracy of plus or minus 3.6 degrees F. The switch must have a field-adjustable setpoint with a range of at least 30 to 50 degrees F. The switch must have two sets of contacts, and each contact must have a rating greater than its connected load. Contacts must open or close upon drop of temperature below setpoint as indicated and must remain in this state until reset.

2.6.11.2 Pipe Mount Temperature Limit Switch (Aquastat)

Pipe mount temperature limit switches (aquastats) must have a field adjustable setpoint between 60 and 90 degrees F, an accuracy of plus or minus 3.6 degrees F and a 10 degrees F fixed deadband. The switch must have two sets of contacts, and each contact must have a rating greater than its connected load. Contacts must open or close upon change of temperature above or below setpoint as indicated.

2.6.12 Damper End Switches

Each end switch must be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure must be suitable for mounting on the duct exterior and must permit setting the position of the trip lever that actuates the switch. The trip lever must be aligned with the damper blade.

End switches integral to an electric damper actuator are allowed as long as at least one is adjustable over the travel of the actuator.

2.6.13 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor must monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor must automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.7 OUTPUT DEVICES

2.7.1 Actuators

Actuators must be electric (electronic). All actuators must be normally open (NO), normally closed (NC) or fail-in-last-position (FILP) as indicated. Normally open and normally closed actuators must be of mechanical spring return type. Electric actuators must have an electronic cut off or other means to provide burnout protection if stalled. Actuators must have a visible position indicator. Electric actuators must provide position feedback to the controller as indicated. Actuators must smoothly and fully open or close the devices to which they are applied. Electric actuators must have a full stroke response time in both directions of 90 seconds or less at rated load. Electric actuators must be of the foot-mounted type with an oil-immersed gear train or the direct-coupled type. Where multiple electric actuators operate from a common signal, the actuators must provide an output signal identical to its input signal to the additional devices. All actuators must be rated for their operating environment. Actuators used outdoors must be designed and rated for outdoor use. Actuators under continuous exposure to water, such as those used in sumps, must be submersible.

Actuators incorporating an integral network connection are considered DDC Hardware and must meet the DDC Hardware requirements of Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

Each device requiring 120V or 24V power shall either derive the power from the device being controlled or from electrical circuit noted for DDC controls on electrical plans. Contractor is responsible for routing power from source to controller or device requiring power.

2.7.1.1 Valve Actuators

Valve actuators must provide shutoff pressures and torques as indicated on the Valve Schedule.

2.7.1.2 Damper Actuators

Damper actuators must provide the torque necessary per damper manufacturer's instructions to modulate the dampers smoothly over its full range of operation and torque must be at least 6 inch-pounds/1 square foot of damper area for opposed blade dampers and 9 inch-pounds/1 square foot of damper area for parallel blade dampers.

2.7.1.3 Electric Actuators

Each actuator must have distinct markings indicating the full-open and full-closed position Each actuator must deliver the torque required for continuous uniform motion and must have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators must function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds.

a. Two-position actuators must be single direction, spring return, or reversing type. Two position actuator signals may either be the control power voltage or line voltage as needed for torque or appropriate interlock circuits.

b. Modulating actuators must be capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators must be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Modulating actuator input signals can either be a 4 to 20 mAdc or a 0-10 VDC signal.

c. Floating or pulse width modulation actuators are acceptable for non-fail safe applications unless indicated otherwise provided that the floating point control (timed actuation) must have a scheduled re-calibration of span and position no more than once a day and no less than once a week. The schedule for the re-calibration should not affect occupied conditions and be staggered between equipment to prevent falsely loading or unloading central plant equipment.

2.7.2 Relays

Relays must have contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light must be lit when the coil is energized and off when coil is not energized.

Control relay contacts must have utilization category and ratings selected for the application. Each set of contacts must incorporate a normally open (NO), normally closed (NC) and common contact. Relays must be rated for a minimum life of one million operations.

2.8 USER INPUT DEVICES

User Input Devices, including potentiometers, switches and momentary contact push-buttons. Potentiometers must be of the thumb wheel or sliding bar type. Momentary Contact Push-Buttons may include an adjustable timer for their output. User input devices must be labeled for their function.

2.9 MULTIFUNCTION DEVICES

Multifunction devices are products which combine the functions of multiple sensor, user input or output devices into a single product. Unless otherwise specified, the multifunction device must meet all requirements of each component device. Where the requirements for the component devices conflict, the multifunction device must meet the most stringent of the requirements.

2.9.1 Current Sensing Relay Command Switch

The Current Sensing Relay portion must meet all requirements of the Current Sensing Relay input device. The Command Switch portion must meet all requirements of the Relay output device except that it must have at least one normally-open (NO) contact.

Current Sensing Relays used for Variable Frequency Drives must be rated for Variable Frequency applications unless installed on the source side of the drive. If used in this situation, the threshold for showing status must be set to allow for the VFD's control power when the drive is not enabled and provide indication of operation when the drive is enabled at minimum speed.

2.9.2 Space Sensor Module

Space Sensor Modules must be multifunction devices incorporating a temperature sensor and one or more of the following as specified and indicated on the Space Sensor Module Schedule:

a. A temperature indicating device.

b. A User Input Device which must adjust a temperature setpoint output.

c. A User Input Momentary Contact Button and an output to the control system indicating zone occupancy.

Space Sensor Modules cannot contain mercury (Hg).

2.9.2.1 Blank Plate

Unless otherwise noted provide all rooms with temperature sensor with blank plate and no display or user interface.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General Installation Requirements

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1.1 Device Mounting Criteria

All devices must be installed in accordance with manufacturer's recommendations and as specified and indicated. Control devices to be installed in piping and ductwork must be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements must not be used except as specified. Spare thermowells must be installed adjacent to each thermowell containing a sensor and as indicated. Devices located outdoors must have a weathershield.

3.1.1.2 Labels and Tags

Match labels and tags to the unique identifiers indicated on the As-Built drawings. Label all enclosures and instrumentation. Tag all sensors and actuators in mechanical rooms. Tag airflow measurement arrays to show flow rate range for signal output range, duct size, and pitot tube AFMA flow coefficient. Tag duct static pressure taps at the location of the pressure tap. Provide plastic or metal tags, mechanically attached directly to each device or attached by a metal chain or wire. Labels exterior to protective enclosures must be engraved plastic and mechanically attached to the enclosure or instrumentation. Labels inside protective enclosures may attached using adhesive, but must not be hand written.

3.1.2 Weathershield

Provide weathershields for sensors located outdoors. Install weathershields such that they prevent the sun from directly striking the

sensor and prevent rain from directly striking or dripping onto the sensor. Install weather shields with adequate ventilation so that the sensing element responds to the ambient conditions of the surroundings. When installing weathershields near outside air intake ducts, install them such that normal outside air flow does not cause rainwater to strike the sensor.

3.1.3 Room Instrument Mounting

Mount room instruments, including but not limited to wall mounted non-adjustable space sensor modules and sensors located in occupied spaces, 48 inches above the floor unless otherwise indicated. Install adjustable devices to be ADA compliant unless otherwise indicated on the Room Sensor Schedule:

a. Wall mount all other Space Sensor Modules, but do not mount on an exterior wall.

3.1.4 Indication Devices Installed in Piping and Liquid Systems

Provide snubbers for gauges in piping systems subject to pulsation. Install thermometers and temperature sensing elements in liquid systems in thermowells. Provide spare Pressure/Temperature Ports (Pete's Plug) for all temperature and pressure sensing elements installed in liquid systems for calibration/testing.

3.1.5 Switches

3.1.5.1 Temperature Limit Switch

Provide a temperature limit switch (freezestat) to sense the temperature at the location indicated. Provide a sufficient number of temperature limit switches (freezestats) to provide complete coverage of the duct section but no less than 1 foot in length per square foot of cross sectional area. Install manual reset limit switches in approved, accessible locations where they can be reset easily. Install temperature limit switch (freezestat) sensing elements in a side-to-side (not top-to-bottom) serpentine pattern with the relay section at the highest point and in accordance with the manufacturer's installation instructions.

3.1.5.2 Hand-Off Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.6 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate and install sensors according to manufacturer’s instructions. Select sensors only for intended application as designated or recommended by manufacturer.

3.1.6.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of all user-adjustable sensors at the height indicated.

Non-user-adjustable sensors can be mounted as indicated in paragraph ROOM INSTRUMENT MOUNTING.

3.1.6.2 Duct Temperature Sensors

3.1.6.2.1 Probe Type

Place tip of the sensor in the middle of the airstream or in accordance with manufacturer's recommendations or instructions. Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. When installed in insulated duct, provide enclosure or stand off fitting to accommodate the thickness of duct insulation to allow for maintenance or replacement of the sensor and wiring terminations. Seal the duct insulation penetration vapor tight.

3.1.6.2.2 Averaging Type

Weave the sensing element in a serpentine fashion from side to side perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports in accordance with manufacturer's installation instructions. Avoid tight radius bends or kinking of the sensing element. Prevent contact between the sensing element and the duct or air handler internals. Provide a duct access door at the sensor location. The access door must be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors must be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.6.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. When installed on insulated piping, provide stand enclosure or stand off fitting to accommodate the thickness of the pipe insulation and allow for maintenance or replacement of the sensor or wiring terminations. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells must not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior ensuring contact between the sensor and the well.

3.1.6.4 Outside Air Temperature Sensors

Provide outside air temperature sensors on the building's north side with a protective weather shade that does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain. Location must not be near exhaust hoods and other areas such that it is not influenced by radiation or convection sources which may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.7 Air Flow Measurement Arrays (AFMA)

Locate Outside Air AFMAs downstream from the Outside Air filters.

Install AFMAs with the manufacturer's recommended minimum distances between upstream and downstream disturbances. Airflow straighteners may

be used to reduce minimum distances as recommended by the AFMA manufacturer.

3.1.8 Duct Static Pressure Sensors

Locate the duct static pressure sensing tap at 75 percent of the distance between the first and last air terminal units as indicated on the design documents. If the transmitter output is a 0-10 Vdc signal, locate the transmitter in the same enclosure as the air handling unit (AHU) controller for the AHU serving the terminal units. If a remote duct static pressure sensor is to be used, run the signal wire back to the controller for the air handling unit.

3.1.9 Relative Humidity Sensors

Install relative humidity sensors in supply air ducts at least 10 feet downstream of humidity injection elements.

3.1.10 Meters

3.1.10.1 Flowmeters

Install flowmeters to ensure minimum straight unobstructed piping for at least 10 pipe diameters upstream and at least 5 pipe diameters downstream of the flowmeter, and in accordance with the manufacturer's installation instructions.

3.1.11 Dampers

3.1.11.1 Damper Actuators

Provide spring return actuators which fail to a position that protects the served equipment and space on all control dampers related to freeze protection or force protection. For all outside, makeup and relief dampers provide dampers which fail closed. Terminal fan coil units, terminal VAV units, convectors, and unit heaters nay be non-spring return unless indicated otherwise. Do not mount actuators in the air stream. Do not connect multiple actuators to a common drive shaft. Install actuators so that their action seal the damper to the extent required to maintain leakage at or below the specified rate and so that they move the blades smoothly throughout the full range of motion.

3.1.11.2 Damper Installation

Install dampers straight and true, level in all planes, and square in all dimensions. Dampers must move freely without undue stress due to twisting, racking (parallelogramming), bowing, or other installation error. External linkages must operate smoothly over the entire range of motion, without deformation or slipping of any connecting rods, joints or brackets that will prevent a return to it's normal position. Blades must close completely and leakage must not exceed that specified at the rated static pressure. Provide structural support for multi-section dampers. Acceptable methods of structural support include but are not limited to U-channel, angle iron, corner angles and bolts, bent galvanized steel stiffeners, sleeve attachments, braces, and building structure. Where multi-section dampers are installed in ducts or sleeves, they must not sag due to lack of support. Do not use jackshafts to link more than three damper sections. Do not use blade to blade linkages. Install outside and return air dampers such that their blades direct their respective air

streams towards each other to provide for maximum mixing of air streams.

3.1.12 Valves

Install the valves in accordance with the manufacturer's instructions.

3.1.12.1 Valve Actuators

Provide spring return actuators on all control valves where freeze protection is required. Spring return actuators for terminal fan coil units, terminal VAV units, convectors, and unit heaters are not required unless indicated otherwise.

3.1.13 Wire and Cable

Provide complete electrical wiring for the Control System, including wiring to transformer primaries. Wire and Cable must be installed without splices between control devices and in accordance with NFPA 70 and NFPA 90A. Instrumentation grounding must be installed per the device manufacturer's instructions and as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Test installed ground rods as specified in IEEE 142. Cables and conductor wires must be tagged at both ends, with the identifier indicated on the shop drawings. Electrical work must be as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and as indicated. Wiring external to enclosures must be run in raceways.

Install control circuit wiring not in raceways in a neat and safe manner. Wiring must not use the suspended ceiling system (including tiles, frames or hangers) for support. Where conduit or raceways are required, control circuit wiring must not run in the same conduit/raceway as power wiring over 50 volts. Run all circuits over 50 volts in conduit, metallic tubing, covered metal raceways, or armored cable.

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SECTION 23 09 23.02

BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS
02/19

PART 1 GENERAL

1.1 SUMMARY

Provide a complete Direct Digital Control (DDC) system, suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown and in accordance with Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

1.1.1 Compatibility

Provide systems compatible with the buildings existing Johnson Controls Metasys system.

1.1.2 System Requirements

Provide a system meeting the requirements of both Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and this Section and with the following characteristics:

a. Except for Gateways, the control system must be an open implementation of BACnet technology using ASHRAE 135 as the communications protocol. The system must use standard ASHRAE 135 Objects and Properties. The system must use standard ASHRAE 135 Services exclusively for communication over the network. Gateways to packaged units must communicate with other DDC hardware using ASHRAE 135 exclusively and may communicate with packaged equipment using other protocols. The control system must be installed such that any two devices on the Internetwork can communicate using standard ASHRAE 135 Services.

b. Install and configure control hardware to provide ASHRAE 135 Objects and Properties as indicated and as needed to meet the requirements of this specification.

1.1.3 Verification of Specification Requirements

Review all specifications related to the control system installation and advise the Contracting Officer of any discrepancies before performing any work. If Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC or any other Section referenced in this specification is not included in the project specifications advise the Contracting Officer and either obtain the missing Section or obtain Contracting Officer approval before performing any work.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2016) BACnet—A Data Communication Protocol for Building Automation and Control Networks

BACNET INTERNATIONAL (BTL)

BTL Guide	(v.49; 2017) BACnet Testing Laboratory Implementation Guidelines

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.3	(2018) Ethernet

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-485	(1998a; R 2012) Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 916	(2015; Reprint Oct 2021) UL Standard for Safety Energy Management Equipment

1.3 DEFINITIONS

For definitions related to this section, see Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

1.4 SUBMITTALS

Submittal requirements related to this Section are specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

PART 2 PRODUCTS

All products used to meet this specification must meet the indicated requirements, but not all products specified here will be required by every project. All products must meet the requirements both Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and this Section.

2.1 NETWORK HARDWARE

2.1.1 BACnet Router

All BACnet Routers must be BACnet/IP Routers and must perform layer 3 routing of ASHRAE 135 packets over an IP network in accordance with ASHRAE 135 Annex J and Clause 6. The router must provide the appropriate connection to the IP network and connections to one or more ASHRAE 135 MS/TP networks. Devices used as BACnet Routers must meet the requirements for DDC Hardware, and must support the NM-RC-B BIBB.

2.1.2 BACnet Gateways

In addition to the requirements for DDC Hardware, the BACnet Gateway must meet the following requirements:

a. It must perform bi-directional protocol translation from one non-ASHRAE 135 protocol to ASHRAE 135. BACnet Gateways must incorporate a network connection to an ASHRAE 135 network (either BACnet over IP in accordance with Annex J or MS/TP) and a separate connection appropriate for the non-ASHRAE 135 protocol and media.

b. It must retain its configuration after a power loss of an indefinite time, and must automatically return to their pre-power loss state once power is restored.

c. It must allow bi-directional mapping of data between the non-ASHRAE 135 protocol and Standard Objects as defined in ASHRAE 135. It must support the DS-RP-B BIBB for Objects requiring read access and the DS-WP-B BIBB for Objects requiring write access.

d. It must support the DS-COV-B BIBB.

Although Gateways must meet DDC Hardware requirements they are not DDC Hardware and must not be used when DDC Hardware is required.

2.1.3 Ethernet Switch

Ethernet Switches must autoconfigure between 10,100 and 1000 megabits per second (MBPS).

2.2 CONTROL NETWORK WIRING

a. BACnet MS/TP communications wiring must be in accordance with ASHRAE 135. The wiring must use shielded, three wire (twisted-pair with reference) cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors must be less than 30 pF per foot.

b. Building Control Network Backbone IP Network must use Ethernet media. Ethernet cables must be CAT-5e at a minimum and meet all requirements of IEEE 802.3.

2.3 DIRECT DIGITAL CONTROL (DDC) HARDWARE

2.3.1 General Requirements

All DDC Hardware must meet the following requirements:

a. It must be locally powered and must incorporate a light to indicate the device is receiving power. Each device requiring 120V or 24V power shall either derive the power from the device being controlled or from electrical circuit noted for DDC controls on electrical plans. Contractor is responsible for routing power from source to controller or device requiring power.

b. It must conform to the BTL Guide.

c. It must be BACnet Testing Laboratory (BTL) Listed.

d. The Manufacturer's Product Data submittal for each piece of DDC Hardware must include the Protocol Implementation Conformance Statement (PICS) for that hardware as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

e. It must communicate and be interoperable in accordance with ASHRAE 135 and have connections for BACnet IP or MS/TP control network wiring.

f. Other than devices controlling terminal units or functioning solely as a BACnet Router, it must support DS-COV-B, DS-RPM-A and DS-RPM-B BIBBs.

g. Devices supporting the DS-RP-A BIBB must also support the DS-COV-A BIBB.

h. Application programs, configuration settings and communication information must be stored in a manner such that they persist through loss of power:

(1) Application programs must persist regardless of the length of time power is lost.

(2) Configured settings must persist for any loss of power less than 2,500 hours.

(3) Communication information, including but not limited to COV subscriptions, event reporting destinations, Notification Class Object settings, and internal communication settings, must persist for any loss of power less than 2,500 hours.

i. Internal Clocks:

(1) Clocks in DDC Hardware incorporating a Clock must continue to function for 120 hours upon loss of power to the DDC Hardware.

(2) DDC Hardware incorporating a Clock must support the DM-TS-B or DM-UTC-B BIBB.

j. It must have all functionality indicated and required to support the application (Sequence of Operation or portion thereof) in which it is used, including but not limited to providing Objects as specified and as indicated on the Points Schedule.

k. In addition to these general requirements and the DDC Hardware Input-Output (I/O) Function requirements, all DDC Hardware must also meet any additional requirements for the application in which it is used (e.g., scheduling, alarming, trending, etc.).

l. It must meet FCC Part 15 requirements and have UL 916 or equivalent safety listing.

m. Device must support Commandable Objects to support Override requirements as detailed in PART 3 EXECUTION.

n. User interfaces which allow for modification of Properties or settings must be password-protected.

o. Devices communicating BACnet MS/TP must meet the following requirements:

(1) Must have a configurable Max_Master Property.

(2) DDC Hardware other than hardware controlling a single terminal unit must have a configurable Max_Info_Frames Property.

(3) Must respond to any valid request within 50 msec with either the appropriate response or with a response of "Reply Postponed".

(4) Must use twisted pair with reference and shield (3-wire media) wiring.

p. Devices communicating BACnet/IP must use UDP Port 0xBAC0. Devices with configurable UDP Ports must default to 0xBAC0.

q. All Device IDs, Network Numbers, and BACnet MAC addresses of devices must be fully configurable without limitation, except MS/TP MAC addresses may be limited by ASHRAE 135 requirements.

r. DDC Hardware controlling a single terminal unit must have:

(1) Objects (including the Device Object) with an Object Name Property of at least 8 characters in length.

(2) A configurable Device Object Name.

(3) A configurable Device Object Description Property at least 16 characters in length.

s. Except for Objects in DDC Hardware controlling a single terminal unit, all Objects (including Device Objects) must:

(1) Have a configurable Object Name Property of at least 12 characters in length.

(2) Have a configurable Object Description Property of at least 24 characters in length.

t. For programmable DDC Hardware, provide and license to the project site all programming software required to program the Hardware in accordance with Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

u. For programmable DDC Hardware, provide copies of the installed application programs (all software that is not common to every controller of the same manufacturer and model) as source code compatible with the supplied programming software in accordance with Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. The submitted application program must be the complete application necessary for controller to function as installed and be sufficient to allow replacement of the installed controller with another controller of the same type.

2.3.2 Hardware Input-Output (I/O) Functions

DDC Hardware incorporating hardware input-output (I/O) functions must meet the following requirements:

2.3.2.1 Analog Inputs

DC Hardware analog inputs (AIs) must be implemented using ASHRAE 135

Analog Input Objects and perform analog to digital (A-to-D) conversion with a minimum resolution of 8 bits plus sign or better as needed to meet the accuracy requirements specified in Section 23 09 00. Signal conditioning including transient rejection must be provided for each analog input. Analog inputs must be capable of being individually calibrated for zero and span. Calibration via software scaling performed as part of point configuration is acceptable. The AI must incorporate common mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10,000 ohms.

2.3.2.2 Analog Outputs

DDC Hardware analog outputs (AOs) must be implemented using ASHRAE 135 Analog Output Objects and perform digital to analog (D-to-A) conversion with a minimum resolution of 8 bits plus sign, and output a signal with a range of 4-20 mAdc or 0-10 Vdc. Analog outputs must be capable of being individually calibrated for zero and span. Calibration via software scaling performed as part of point configuration is acceptable. DDC Hardware with Hand-Off-Auto (H-O-A) switches for analog outputs must provide for overriding the output through the range of 0 percent to 100 percent.

2.3.2.3 Binary Inputs

DDC Hardware binary inputs (BIs) must be implemented using ASHRAE 135 Binary Input Objects and accept contact closures and must ignore transients of less than 5 milli-second duration. Protection against a transient 50VAC must be provided.

2.3.2.4 Binary Outputs

DDC Hardware binary outputs (BOs) must be implemented using ASHRAE 135 Binary Output Objects and provide relay contact closures or triac outputs for momentary and maintained operation of output devices. DDC Hardware with H-O-A switches for binary outputs must provide for overriding the output open or closed.

2.3.2.4.1 Relay Contact Closures

Closures must have a minimum duration of 0.1 second. Relays must provide at least 180V of isolation. Electromagnetic interference suppression must be provided on all output lines to limit transients to 50 Vac. Minimum contact rating must be 0.5 amperes at 24 Vac.

2.3.2.4.2 Triac Outputs

Triac outputs must provide at least 180 V of isolation. Minimum contact rating must be 0.5 amperes at 24 Vac.

2.3.2.5 Pulse Accumulator

DDC Hardware pulse accumulators must be implemented using either an ASHRAE 135 Accumulator Object or an ASHRAE 135 Analog Value Object where the Present_Value is the totalized pulse count. Pulse accumulators must accept contact closures, ignore transients less than 5 msec duration, protect against transients of 50 VAC, and accept rates of at least 20 pulses per second.

2.3.2.6 ASHRAE 135 Objects for Hardware Inputs and Outputs

The requirements for use of ASHRAE 135 objects for hardware input and outputs includes devices where the hardware sensor or actuator is integral to the controller (e.g., a VAV box with integral damper actuator, a smart sensor, a VFD, etc.).

2.3.2.7 Integrated H-O-A Switches

Where integrated H-O-A switches are provided on hardware outputs, controller must provide means of monitoring position or status of H-O-A switch. This feedback may be provided via any valid BACnet method, including the use of proprietary Objects, Properties, or Services.

2.3.3 Local Display Panel (LDP)

The Local Display Panels (LDPs) must be DDC Hardware with a display and navigation buttons or a touch screen display, and must provide display and adjustment of ASHRAE 135. Properties as indicated on the Points Schedule and as specified. LDPs must be either BTL Listed as a B-OD, B-OWS, B-AWS, or be an integral part of another piece of DDC Hardware listed as a B-BC. For LDPs listed as B-OWS or B-AWS, the hardware must be BTL listed and the product must come factory installed with all applications necessary for the device to function as an LDP.

The adjustment of values using display and navigation buttons must be password protected.

2.3.4 Expansion Modules and Tethered Hardware

A single piece of DDC Hardware may consist of a base unit and also:

a. An unlimited number of hardware expansion modules, where the individual hardware expansion modules are designed to directly connect, both mechanically and electrically, to the base unit hardware. The expansion modules must be commercially available as an optional add-on to the base unit.

b. A single piece of hardware connected (tethered) to a base unit by a single cable where the cable carries a proprietary protocol between the base unit and tethered hardware. The tethered hardware must not contain control logic and be commercially available as an optional add-on to the base unit as a single package.

   Note that this restriction on tethered hardware does not apply to sensors or actuators using standard binary or analog signals (not a communications protocol); sensors or actuators using standard binary or analog signals are not considered part of the DDC Hardware.

Hardware capable of being installed stand-alone, or without a separate base unit, is DDC Hardware and must not be used as expansion modules or tethered hardware.

2.3.5 Supervisory Control Requirements

2.3.5.1 Scheduling Hardware

DDC Hardware used for scheduling must meet the following requirements:

a. It must be BTL Listed as a B-BC and support the SCHED-E-B BIBB.

b. It is preferred, but not required, that devices support the DM-OCD-B BIBB on all Calendar and Schedule Objects, such that a front end BTL listed as a B-AWS may create or delete Calendar and Schedule Objects. It is also preferred but not required that devices supporting the DM-OCD-B BIBB accept any valid value for properties of Calendar and Schedule Objects. Note that there are additional requirements in the EXECUTION Part of this Section for Devices which do not support the DM-OCD-B BIBB as specified.

c. The Date_List property of all Calendar Objects must be writable.

d. The Present_Value Property of Schedule must support the following values: 1, 2, 3, 4.

2.3.5.2 Alarm Generation Hardware

DDC Hardware used for alarm generation must meet the following requirements:

a. Device must support the AE-N-I-B BIBB.

b. The Recipient_List Property must be Writable for all Notification Class Objects used for alarm generation.

c. For all Objects implementing Intrinsic Alarming, the following Properties must be Writable:

(1) Time_Delay.

(2) High_Limit.

(3) Low_Limit.

(4) Deadband.

(5) Event_Enable.

(6) If the issue date of this project specification is after 1 January 2016, Time_Delay_Normal must be writable.

d. For Event Enrollment Objects used for alarm generation, the following Properties must be Writable:

(1) Event_Parameters.

(2) Event_Enable.

(3) If the issue date of this project specification is after 1 January 2016, Time_Delay_Normal must be writable.

e. It is preferred, but not required, that devices support the DM-OCD-B BIBB on all Notification Class Objects and Event Enrollment Objects, such that a front end BTL listed as a B-AWS may create or delete Notification Class Objects and Event Enrollment Objects. It is also preferred, but not required that devices supporting the DM-OCD-B BIBB accept any valid value as an initial value for properties of Notification Class Objects and Event Enrollment Objects. Note that

there are additional requirements in the EXECUTION Part of this Section for devices which do not support the DM-OCD-B BIBB as specified.

f. Devices provided to meet the the requirements indicated under "Support for Future Alarm Generation" in the EXECUTION part of this specification must support the AE-N-E-B BIBB.

2.3.5.3 Trending Hardware

DDC Hardware used for collecting trend data must meet the following requirements:

a. Device must support Trend Log or Trend Log Multiple Objects.

b. Device must support the T-VMT-I-B BIBB.

c. Devices provided to meet the EXECUTION requirement for support of Future Trending must support the T-VMT-E-B BIBB.

d. The following properties of all Trend Log or Trend Log Multiple Objects must be present and Writable:

Start_Time
Stop_Time
Log_DeviceObjectProperty
Log Interval: Log interval must support an interval of at least 60 minutes duration.

e. Trend Log Objects must support using Intrinsic Reporting to send a BUFFER_FULL event.

f. The device must have a Notification Class Object for the BUFFER_FULL event. The Recipient_List Property must be Writable.

g. Devices must support values of at least 1,000 for Buffer_Size Properties.

h. It is preferred, but not required, that devices support the DM-OCD-B BIBB on all Trend Log Objects, such that a front end BTL listed as a A-AWS may create or delete Trend Log Objects. It is also preferred, but not required that devices supporting the DM-OCD-B BIBB accept any valid value as an initial value for properties of Trend Log Objects. Note that there are additional EXECUTION requirements for devices which do not support the DM-OCD-B BIBB as specified.

PART 3 EXECUTION

3.1 CONTROL SYSTEM INSTALLATION

3.1.1 Building Control Network (BCN)

Install the Building Control Network (BCN) as a single BACnet Internetwork consisting of a single IP network as the BCN Backbone and zero or more BACnet MS/TP networks. Note that in some cases there may only be a single device on the BCN Backbone.

Except as permitted for the non-BACnet side of Gateways, use exclusively ASHRAE 135 networks.

3.1.1.1 Building Control Network IP Backbone

Install IP Network Cabling in conduit. Install Ethernet Switches in lockable enclosures. Install the Building Control Network (BCN) IP Backbone such that it is available at the Facility Point of Connection (FPOC) location as indicated. When the FPOC location is a room number, provide sufficient additional media to ensure that the Building Control Network (BCN) IP Backbone can be extended to any location in the room.

Use UDP port 0xBAC0 for all BACnet traffic on the IP network.

3.1.1.2 BACnet MS/TP Networks

When using MS/TP, provide MS/TP networks in accordance with ASHRAE 135 and in accordance with the ASHRAE 135 figure "Mixed Devices on 3-Conductor Cable with Shield" (Figure 9-1.4 in the 2012 version of ASHRAE 135). Ground the shield at the BACnet Router and at no other point. Ground the reference wire at the BACnet Router through a 100 ohm resistor and do not ground it at any other point. In addition:

a. Provide each segment in a doubly terminated bus topology in accordance with TIA-485.

b. Provide each segment with 2 sets of network bias resistors in accordance with ASHRAE 135, with one set of resistors at each end of the MS/TP network.

c. Use 3 wire (twisted pair and reference) with shield media for all MS/TP media installed inside. Use fiber optic isolation in accordance with ASHRAE 135 for all MS/TP media installed outside buildings, or between multiple buildings.

d. For 18 AWG cable, use segments with a maximum length of 4000 ft. When using greater distances or different wire gauges comply with the electrical specifications of TIA-485.

e. For each controller that does not use the reference wire provide transient suppression at the network connection of the controller if the controller itself does not incorporate transient suppression.

f. Install no more than 32 devices on each MS/TP segment. Do not use MS/TP to MS/TP routers.

g. Connect each MS/TP network to the BCN backbone via a BACnet Router.

h. For BACnet Routers, configure the MS/TP MAC address to 0. Assign MAC Addresses to other devices consecutively beginning at 1, with no gaps.

i. Configure the Max_Master Property of all devices to be 31.

3.1.1.3 Building Control Network (BCN) Installation

Provide a building control network meeting the following requirements:

a. Install all DDC Hardware connected to the Building Control Network.

b. Where multiple pieces of DDC Hardware are used to execute one sequence, install all DDC Hardware executing that sequence on a single

MS/TP network dedicated to that sequence.

c. Traffic between BACnet networks must be exclusively via BACnet routers.

3.1.2 DDC Hardware

Install all DDC Hardware that connects to an IP network in lockable enclosure. Install other DDC Hardware that is not in suspended ceilings in lockable enclosures. For all DDC hardware with a user interface, coordinate with site to determine proper passwords and configure passwords into device.

a. Except for zone sensors (thermostats), install all Tethered Hardware within 6 feet of its base unit.

b. Install and configure all BTL-Listed devices in a manner consistent with their BTL Listing such that the device as provided still meets all requirements necessary for its BTL Listing.

c. Install and configure all BTL-Listed devices in a manner consistent with the BTL Device Implementation Guidelines such that the device as provided meets all those Guidelines.

3.1.2.1 Device Identifiers, Network Addresses, and IP addresses

a. Do not use any Device Identifier or Network Number already used by another BACnet system at the project site. Coordinate Device IDs and Network Numbers with the installation. The installation POC is coordinated through the Contracting Officer.

b. Coordinate device IP addresses with installation. The installation POC is coordinated through the Contracting Officer.

3.1.2.2 Object Name Property and Object Description Property

Configure the Object_Names and Object_Descriptions properties of all Objects (including Device Objects) as indicated on the Points Schedule (Point Name and Point Description) and as specified. At a minimum:

a. Except for DDC Hardware controlling a single terminal unit, configure the Object_Name and Object_Description properties of all Objects (including Device Objects) as indicated on the Points Schedule and as specified.

b. In DDC Hardware controlling a single terminal unit, configure the Device Object_Name and Device Object_Description as indicated on the Points Schedule and as specified.

When Points Schedule entries exceed the length limitations in the device, notify the Contracting Officer and provide recommended alternatives for approval.

3.1.2.3 Hand-Off-Auto (H-O-A) Switches

Provide Hand-Off-Auto (H-O-A) switches for all DDC Hardware analog outputs and binary outputs used for control of systems other than terminal units, as specified and as indicated on the Points Schedule. Provide H-O-A switches that are integral to the controller hardware, an external device co-located with (in the same enclosure as) the controller, integral to the

controlled equipment, or an external device co-located with (in the same enclosure as) the controlled equipment.

a. For H-O-A switches integral to DDC Hardware, meet the requirements specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE.

b. For external H-O-A switches used for binary outputs, provide for overriding the output open or closed.

c. For external H-O-A switches used for analog outputs, provide for overriding to 0 percent or 100 percent.

3.1.2.4 Local Display Panels

Provide LDPs to display and override values of ASHRAE 135 Object Properties as indicated on the Points Schedule. Install LDPs displaying points for anything other than a terminal unit in the same room as the equipment. Install LDPs displaying points for only terminal units in a mechanical room central to the group of terminal units it serves. For LDPs using WriteProperty to commandable objects to implement an override, write values with priority 9.

3.1.2.5 MS/TP Slave Devices

Configure all MS/TP devices as Master devices. Do not configure any devices to act as slave devices.

3.1.2.6 Change of Value (COV) and Read Property

a. To the greatest extent possible, configure all devices to support the SubscribeCOV service (the DS-COV-B BIBB). At a minimum, all devices supporting the DS-RP-B BIBB, other than devices controlling only a single terminal unit, must be configured to support the DS-COV-B BIBB.

b. Whenever supported by the server side, configure client devices to use the DS-COV-A BIBB.

3.1.2.7 Engineering Units

Configure devices to use SI units as follows:

a. Temperature in degrees F.

b. Air or natural gas flows in cubic feet per minute (CFM).

c. Water in gallons per minute (GPM).

d. Differential Air pressures in inches of water column (IWC).

e. Water, and natural gas pressures in PSI.

f. Enthalpy in BTU/lb.

g. Heating and cooling energy in MBTU (1MBTU = 1,000,000 BTU).

h. Cooling load in tons (1 ton = 12,000 BTU/hour).

i. Heating load in MBTU/hour (1MBTU = 1,000,000 BTU).

j. Electrical Power: kilowatts (kW).

k. Electrical Energy: kilowatt-hours (kWh).

3.1.2.8 Occupancy Modes

Use the following correspondence between value and occupancy mode whenever an occupancy state or value is required:

a. OCCUPIED mode: A value of one.

b. UNOCCUPIED mode: A value of two.

c. WARM-UP/COOL-DOWN (PRE-OCCUPANCY) mode: A value of three.

Note that elsewhere in this Section the Schedule Object is required to also support a value of four, which is reserved for future use. Also note that the behavior of a system in each of these occupancy modes is indicated in the sequence of operation for the system.

3.1.2.9 Use of BACnet Objects

Use only standard non-proprietary ASHRAE 135 Objects and services to accomplish the project scope of work as follows:

a. Use Analog Input or Analog Output Objects for all analog hardware I/O. Do not use Analog Value Object for analog hardware I/O).

b. Use Binary Input or Binary Output Objects for all binary hardware I/O. Do not use Binary Value Objects for binary hardware I/O.

c. Use Analog Value Objects for analog setpoints.

d. Use Accumulator Objects or Analog Value Objects for pulse inputs.

e. For occupancy modes, use Multistate Value Objects and the correspondence between value and occupancy mode specified in paragraph OCCUPANCY MODES.

f. Use Schedule Objects and Calendar Objects for all scheduling. Use Trend Log Objects or Trend Log Multiple Objects for all trending and Notification Class Objects for trend log upload. Use a combination of Event Enrollment Objects,Intrinsic Alarming, and Notification Class Objects for alarm generation.

g. For all other points shown on the Points Schedule as requiring an ASHRAE 135 Object, use the Object type shown on the Points Schedule or, if no Object Type is shown, use a standard Object appropriate to the point.

3.1.2.10 Use of Standard BACnet Services

Except as noted in this paragraph, for all DDC Hardware use Standard BACnet Services as defined in this specification (which excludes some ASHRAE 135 services) exclusively for application control functionality and communication.

DDC Hardware that cannot meet this requirement may use non-standard services provided they can provide identical functionality using Standard

BACnet Services when communicating with BACnet devices from a different vendor. When implementing non-standard services, document all non-standard services in the DDC Hardware Schedule as specified and as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

3.1.2.11 Device Application Configuration

a. For every property, setting or value shown on the Points Schedule or otherwise indicated as Configurable, provide a value that is retained through loss of power and can be changed via one or more of:

(1) BACnet services (including proprietary services).

(2) Hardware settings on the device.

b. For every property, setting or value shown on the Points Schedule or otherwise indicated as Operator Configurable, provide a value that is retained through loss of power and can be changed via one or more of:

(1) A Writable Property of a standard BACnet Object.

(2) A Property of a standard BACnet Object that is Writable when Out_Of_Service is TRUE and Out_Of_Service is Writable.

3.1.3 Scheduling, Alarming, Trending, and Overrides

3.1.3.1 Scheduling

Configure schedules in BACnet Scheduling Objects to schedule systems as indicated on the Points Schedule and as specified using the indicated correspondence between value and occupancy mode. If no devices supports both the SCHED-E-B and DM-OCD-B BIBBS for Schedule Objects, provide 5 blank Schedule Objects in DDC Hardware BTL listed as B-BCs and supporting the SCHED-E-B BIBB for later use by the site.

Provide a separate schedule for each AHU including it's associated Terminal Units and for each stand-alone Terminal Unit (those not dependent upon AHU service) or group of stand-alone Terminal Units acting according to a common schedule.

3.1.3.2 Configuration of Alarm Generation

a. Send alarm events as Alarms (not Events).

b. Use the ConfirmedNotification Service for alarm events.

c. For alarm generation, support two priority levels for alarms: Critical and non-critical. Configure the Priority of Notification Class Objects to use Priority 112 for critical and 224 for non-critical alarms.

d. Number of Notification Class Objects for Alarm Generation:

(1) If the device implements non-critical alarms, or if any Object in the device supports Intrinsic Alarms, then provide a single Notification Class Object specifically for (shared by) all non-critical alarms.

(2) If the device implements critical alarms, provide a single

Notification Class Object specifically for (shared by) all critical alarms.

(3) If the device implements both critical and non-critical alarms, provide both Notification Class Objects (one for critical, one for non-critical).

(4) If the device controls equipment other than a single terminal unit, provide both Notification Class Objects (one for critical, one for non-critical) even if no alarm generation is required at time of installation.

e. For all intrinsic alarms configure the Limit_Enable Property to set both HighLimitEnable and LowLimitEnable to TRUE. If the specified alarm conditions are for a single-sided alarm (only High_Limit used or only Low_Limit used) assign a value to the unused limit such that the unused alarm condition will not occur.

f. For all objects supporting intrinsic alarming, even if no alarm generation is required during installation, configure the following Properties as follows:

(1) Notification_Class to point to the non-Critical Notification Class Object in that device.

(2) Limit_Enable to enable both the HighLimitEnable and LowLimitEnable.

(3) Notify_Type to Alarm.

g. Use of alarm generation types:

(1) Only use algorithmic alarm generation when intrinsic alarm generation is not supported by the device or object, or when the specific alarm conditions cannot be implemented using intrinsic alarm generation.

(2) Only use remote alarm generation when the alarm cannot be generated using intrinsic or local algorithmic alarm generation on the device containing the referenced property. If remote alarm generation is used, use the same DDC Hardware for all remote alarm generation within a single sequence.

3.1.3.3 Support for Future Alarm Generation

For every piece of DDC Hardware, support future alarm generation capabilities by supporting either intrinsic or additional algorithmic alarming. Provide one of the following:

a. Support intrinsic alarming for every Object used by the application in that device.

b. Support additional Event_Enrollment Objects. For DDC hardware controlling a single terminal unit, support at least one additional object. Otherwise, support at least 4 additional Objects. Support additional Event_Enrollment Objects via one of the following:

(1) Provide unused Event_Enrollment Objects on that device.

(2) Support the DM-OCD-B BIBB and the creation of sufficient

Event_Enrollment Objects on that device.

(3) Provide one or more devices in the IP network that support the AE-N-E-B BIBB and have unused Event_Enrollment Objects.

(4) Provide one or more devices on the IP network that support the AE-N-E-B BIBB, the DM-OCD-B BIBB, and the creation of sufficient Event_Enrollment Objects.

The total number of Event_Enrollment Objects required by the project is the sum of the individual device requirements, and the distribution of Event_Enrollment Objects among devices is not further restricted. (Note this allows a single device to contain many Event_Enrollment Objects satisfying the requirements for multiple devices.)

3.1.3.4 Trend Log Configuration

a. Configure trends in Trend Log or Trend Log Multiple Objects as indicated on the Points Schedule and as specified.

b. Configure all trend logs (including any provided to support future trends) to save data on regular intervals using the BUFFER_FULL event to request trend upload from the front end.

c. Configure Trend Log Objects with a minimum Buffer_Size property value of 1,000 and Trend Log Multiple Objects with a minimum Buffer_Size property value of 1,000 per point trended (for example, a Trend Log Multiple Object used to trend 3 points must have a Buffer_Size Property value of at least 3,000).

d. Configure a Notification Class Object in devices doing trending (including devices supporting future trends) to handle the BUFFER_FULL event.

e. When possible, trend each point using an Object in the device containing the point. When it is necessary to trend using a an Object in another device, all trends not on the same Device as the Object being trended must be on a singe device (i.e., all Trend Log and Trend Log Multiple Objects used for remote trending within a sequence must be on the same device).

f. For each trend log, including any trend logs provided to support future trending, configure the following properties as specified:

(1) Logging_Type: Set to Polling.

(2) Stop_When_Full: Set to Wrap Around.

(3) Buffer_Size: Set to 400 or greater.

(4) Notification_Threshold: Set to 90 percent of full.

(5) Notification_Class: Set to the Notification Class Object in that device.

(6) Event_Enable: Set to TRUE.

(7) Log_Interval: Set to 15 minutes.

g. Future Trending support. Provide support for future trending:

(1) Provide one or more devices on the Building Control Network Backbone IP network which support both the T-VMT-E-B and DM-OCD-B BIBBs for Trend Log Objects. Provide sufficient devices to support the creation of at least one additional Trend Log Object for every terminal unit plus 4 additional Trend Log Objects for every non-terminal unit.

(2) Provide one additional Trend Log Object for every terminal unit plus 4 additional Trend Log Objects for every non-terminal unit in one or more devices on the Building Control Network Backbone IP network that support the T-VMT-E-B BIBB for later use by the site.

(3) A combination of these two methods is permitted provided the total required number of Trend Log Objects is met.

3.1.3.5 Overrides

Provide an override for each point shown on the Points Schedule as requiring an override.

Unless otherwise approved, provide Commandable Objects to support all Overrides. With specific approval from the Contracting Officer, Overrides for points which are not hardware outputs and which are in DDC hardware controlling a single terminal unit may support overrides via an additional Object provided for the override. No other means of implementing Overrides may be used.

a. Where Commandable Objects are used, ensure that WriteProperty service requests with a Priority of 10 or less take precedence over the SEQUENCE VALUE and that WriteProperty service request with a priority of 11 or more have a lower precedence than the SEQUENCE VALUE.

b. For devices implementing overrides via additional Objects, provide Objects which are NOT Written to as part of the normal Sequence of Operations and are Writable when Out_Of_Service is TRUE and Out_Of_Service is Writable. Use this point as an Override of the normal value when Out_Of_Service is TRUE and the normal value otherwise. Note these Objects may be modified as part of the sequence via local processes, but must not be modified by local processes when Out_Of_Service is TRUE.

3.1.4 BACnet Gateways

The requirements in this paragraph do not themselves permit the installation of hardware not meeting the other requirements of this section. Except for proprietary systems specifically indicated in Section 23 09 00, all control hardware installed under this project must meet the requirements of this specification, including the control hardware providing the network interface for a package unit or split system specified under another section. Only use gateways to connect to pre-existing control devices, and to proprietary systems specifically permitted by Section 23 09 00.

3.1.4.1 General Gateway Requirements

Provide BACnet Gateways to connect non-BACnet control hardware in accordance with the following:

a. Configure gateways to map writable data points in the controlled equipment to Writable Properties of Standard Objects as indicated in the Points Schedule and as specified.

b. Configure gateway to map readable data points in the controlled equipment to Readable Properties of Standard Objects as indicated in the Points Schedule and as specified.

c. Configure gateway to support the DS-COV-B BIBB for all points mapped to BACnet Objects.

d. Do not use non-BACnet control hardware for controlling built-up units or any other equipment that was not furnished with factory-installed controls.

e. Do not use non-BACnet control hardware for system scheduling functions.

f. Each gateway must communicate with and perform protocol translation for non-BACnet control hardware controlling one and only one package unit or a single non-BACnet system specifically permitted by Section 23 09 00.

g. Connect one network port on the gateway to the Building Control Backbone IP Network or to a BACnet MS/TP network and the other port to the single piece of controlled equipment or the non-BACnet system specifically permitted by Section 23 09 00.

h. For gateways to existing package units or simple split systems, non-BACnet network wiring connecting the gateway to the package unit must not exceed 10 feet in length and must connect to exactly two devices: The controlled equipment (packaged unit) or split system interface and the gateway.

-- End of Section --

SECTION 23 30 00

HVAC AIR DISTRIBUTION
05/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 201	(2002; R 2011) Fans and Systems
AMCA 210	(2016) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(2014) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2014) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 260 I-P	(2012) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 410	(2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 880 I-P	(2011) Performance Rating of Air Terminals
AHRI 885	(2008; Addendum 2011) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2012) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 62.1	(2010) Ventilation for Acceptable Indoor Air Quality
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
ASHRAE 70	(2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A13.1	(2015) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A924/A924M	(2019) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B766	(1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C553	(2013; R 2019) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C1071	(2019) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM D257	(2014) Standard Test Methods for D-C

	Resistance or Conductance of Insulating Materials
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D3359	(2017) Standard Test Methods for Rating Adhesion by Tape Test
ASTM E2016	(2020) Standard Specification for Industrial Woven Wire Cloth

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 701	(2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition
SMACNA 1972 CD	(2012) HVAC Air Duct Leakage Test Manual - 2nd Edition

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82	Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 181	(2013; Reprint Apr 2017) UL Standard for Safety Factory-Made Air Ducts and Air Connectors
UL 586	(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units
UL 705	(2017; Reprint Oct 2018) UL Standard for Safety Power Ventilators
UL 900	(2015) Standard for Air Filter Units
UL 1995	(2015) UL Standard for Safety Heating and Cooling Equipment
UL Bld Mat Dir	(updated continuously online) Building Materials Directory

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

The drawings show existing equipment and/or conditions based on available site observations and existing record drawings only and may not represent of actual field conditions at the time of construction. The Contractor shall identify and report any discrepancies between the drawings and actual field conditions to the Contracting Officer's representative as part of the demolition process and prior to any new work activities. The Contractor shall provide photos of the discrepancy with suggested solutions to meet design intent without additional cost to the Government.

1.2.1 Mechanical Equipment Identification

The number of charts and diagrams must be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation. Provide labels in accordance with the typical examples below:

SERVICE	LABEL AND TAG DESIGNATION
Air handling unit Number	See schedule on drawings
VAV Box Number	See schedule on drawings
Unit Heaters	See schedule on drawings

Provide removable label on acoustical ceiling tiles below all equipment requiring service or access (terminal units, security manbars, differential pressure sensors, fans, etc.). Label information must include equipment tag designation. Label must adhere to acoustical tile and be visible from finished floor.

Identify similar services with different temperatures or pressures. Where pressures could exceed 125 pounds per square inch, gage, include the maximum system pressure in the label. Label and arrow ductwork and piping in accordance with the following:

a. Each point of entry and exit of pipe passing through walls.

b. Each change in direction, i.e., elbows, tees.

c. In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

d. In long straight runs, locate labels at distances within eyesight of each other not to exceed 75 feet. All labels must be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes	
for Outside Diameters of	Lettering
1/2 thru 1-3/8 inch	1/2 inch
1-1/2 thru 2-3/8 inch	3/4 inch
2-1/2 inch and larger	1-1/4 inch

1.2.3 Color Coding

Color coding of all piping systems must be in accordance with ASME A13.1.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Metal Duct

Metallic Flexible Duct

Insulated Nonmetallic Flexible Duct Runouts; G

Duct Connectors; G

Duct Access Doors; G

Manual Balancing Dampers; G

Sound Attenuation Equipment

Diffusers; G

Registers and Grilles; G

Gravity Hoods; G

In-Line Centrifugal Fans

Air Handling Units; G

Variable Volume, Single Duct Terminal Units; G

Reheat Units; G

Unit Heaters; G

Test Procedures

Indoor Air Quality for Duct Sealants

SD-06 Test Reports

Performance Tests; G RO

Damper Acceptance Test; G RO

Start-Up Reports; G RO

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions

Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G RO

Manual Balancing Dampers; G RO

Air Handling Units; G RO

Variable Volume, Single Duct Terminal Units; G RO

Unit Heaters; G RO

SD-11 Closeout Submittals

Indoor Air Quality During Construction

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

d. Where products are specified to meet or exceed the specified energy efficiency requirement of FEMP-designated or ENERGY STAR covered product categories, equipment selected must have as a minimum the efficiency rating identified under "Energy-Efficient Products" at http://femp.energy.gov/procurement.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use

aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Provide hot-dip galvanized ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Technician Certification

All technicians working on equipment that contain ozone depleting refrigerants must be certified as a Section 608 Technician to meet requirements in 40 CFR 82, Subpart F. Provide copies of technician certifications to the Contracting Officer at least 14 calendar days prior to work on any equipment containing these refrigerants.

1.4.4 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.5 Test Procedures

Conduct performance tests as required in Section 23 05 93.00 06 TESTING, ADJUSTING AND BALANCING FOR HVAC and Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the job site from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide components and equipment that are "standard products" of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. "Standard products" is

defined as being in satisfactory commercial or industrial use for 2 years before bid opening, including applications of components and equipment under similar circumstances and of similar size, satisfactorily completed by a product that is sold on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation, for not less than 6,000 hours exclusive of the manufacturer's factory tests, can be shown. Provide equipment items that are supported by a service organization. In product categories covered by ENERGY STAR or the Federal Energy Management Program, provide equipment that is listed on the ENERGY STAR Qualified Products List or that meets or exceeds the FEMP-designated Efficiency Requirements.

2.2 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Provide identification plates that are layers, black-white-black, engraved to show white letters on black background. Letters must be upper case. Identification plates that are 1-1/2-inches high and smaller must be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high must be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger must have beveled edges. Install identification plates using a compatible adhesive.

2.3 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.4 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Provide premium efficiency type integral size motors in accordance with NEMA MG 1.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with

NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.

d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors. Provide variable frequency drives for motors as specified in Section 26 29 23 ADJUSTABLE SPEED DRIVE SYSTEMS UNDER 600 VOLTS.

2.5 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts must not degrade the surrounding concrete.

2.6 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing. Paint in accordance with Section 09 90 00 PAINTS AND COATINGS.

2.7 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.8 DUCT SYSTEMS

2.8.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification.

a. Ductwork shall be galvanized sheet steel, G90 galvanized coating unless otherwise indicated.

b. Construct ductwork meeting the requirements for the duct system static pressure specified on the drawings.

c. Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.

d. Provide ductwork that meets the requirements of Seal Class A. Provide ductwork in VAV systems upstream of the VAV boxes that meets the requirements of Seal Class A.

e. Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant. Provide duct sealant products that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168 (HVAC duct sealants are classified as "Other" within the SCAQMD Rule 1168 sealants table). Provide validation of indoor air quality for duct sealants.

f. Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable.

g. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

2.8.1.1 Double Wall Duct

Sheetmetal size indicated on the drawings is the size for the inner liner. Shop fabricate ducts and fittings.

Construction comprises of an airtight, vapor barrier, outer sheetmetal shell, a 1 inch insulation layer, and a metal inner liner that completely covers the insulation throughout the system.

Provide insulation conforming to NFPA 90A and ASTM C1071 for thermal conductivity in accordance with ASTM D257.

2.8.1.1.1 Double Wall Acoustic Duct

Construction shall be same as double wall duct except inner liner shall be perforated sheet metal.

2.8.1.2 Metallic Flexible Duct

a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of 2 inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed 5 feet. Secure connections by applying adhesive for 2 inches over rigid duct, apply flexible duct 2 inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless

steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of 1 inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.8.1.3 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated. Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts. Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.8.1.4 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with NFPA 701 and is classified as "flame-retardant fabrics" in UL Bld Mat Dir.

2.8.1.5 Aluminum Ducts

ASTM B209, alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

2.8.1.6 Corrosion Resisting (Stainless) Steel Sheets

ASTM A167.

2.8.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.8.3 Manual Balancing Dampers

Furnish factory manufactured manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators. Install dampers that are 2 gauges heavier than the duct in which installed. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.8.4 Automatic Control Dampers

Provide dampers as specified in Section 23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.

2.8.5 Sound Attenuation Equipment

2.8.5.1 System with total pressure of 4 Inch Water Gauge and Lower

Use sound attenuators only where indicated. Provide factory fabricated sound attenuators that are constructed of galvanized steel sheets. Provide attenuator with outer casing that is not less than 22 gauge. Provide fibrous glass acoustical fill. Provide net sound reduction indicated. Obtain values on a test unit not less than 24 by 24 inches outside dimensions made by a certified nationally recognized independent acoustical laboratory. Provide air flow capacity as indicated or required. Provide pressure drop through the attenuator that does not exceed the value indicated, or that is not in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Acoustically test attenuators with metal duct inlet and outlet sections while under the rated air flow conditions. Include with the noise reduction data the effects of flanking paths and vibration transmission. Construct sound attenuators to be airtight when operating at the internal static pressure indicated or specified for the duct system, but in no case less than 2 inch water gauge.

2.8.6 Diffusers, Registers, and Grilles

Provide factory-fabricated units of steel or aluminum that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70. Provide sound rated and certified inlets and outlets according to ASHRAE 70. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.8.6.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.8.6.2 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.8.7 Gravity Hoods

Fabricate air vents, penthouses, and goosenecks from galvanized steel or aluminum sheets with galvanized or aluminum structural shapes. Provide sheet metal thickness, reinforcement, and fabrication that conform to SMACNA 1966. Accurately fit and secure louver blades to frames. Fold or bead edges of louver blades for rigidity and baffle these edges to exclude driving rain. Provide with bird screen.

2.8.8 Bird Screens and Frames

Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans must not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 120 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the

approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

2.9.1.1 Electronically Commutated Motors

Motors shall be electronically commutated motor where indicated on the drawings. Motors shall be rated for continuous duty, permanently lubricated, heavy duty ball bearing type to match with the fan load. Pre-wired to the specified voltage and phase with internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

Provide with internally mounted potentiometer speed controller or with leads for connection to 0 - 10 VDC external controller as indicated on the drawings.

2.9.1.2 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide motors with open dripproof or totally enclosed enclosure. Provide manual motor starters across-the-line with general-purpose enclosures.

2.9.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.020 inches. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, provide multiple tube supports to prevent tube sag. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

2.9.2.1 Water Coils

Install water coils with a pitch of not less than 1/8 inch/foot of the tube length toward the drain end. Use headers constructed of cast iron, welded steel or copper. Furnish each coil with a plugged vent and drain

connection extending through the unit casing. Provide removable water coils with drain pans. Pressure test coils in accordance with UL 1995.

2.9.3 Air Filters

List air filters according to requirements of UL 900, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of UL 586.

2.9.3.1 Extended Surface Pleated Panel Filters

Provide 2 inch depth, sectional, disposable type filters of the size indicated with a MERV of 8 when tested according to ASHRAE 52.2. Provide initial resistance at 500 fpm that does not exceed 0.36 inches water gauge. Provide UL Class 2 filters, and nonwoven cotton and synthetic fiber mat media. Attach a wire support grid bonded to the media to a moisture resistant fiberboard frame. Bond all four edges of the filter media to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 Cartridge Type Filters

Provide 12 inch depth, sectional, replaceable dry media type filters of the size indicated with a MERV of 13 when tested according to ASHRAE 52.2. Provide UL class 1 filters, and pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow have no effect on filter integrity or performance. Install each filter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.9.3.3 Holding Frames

Fabricate frames from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.9.3.4 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, with white dials with black figures, and graduations with a minimum range of 1 inch of water beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure tips with integral compression fittings, two molded plastic vent valves, two5 foot minimum lengths of 1/4 inch diameter vinyl tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Provide draw-through type units as indicated on the drawings. Units must include fans, coils, airtight insulated casing, prefilters, secondary filter sections, adjustable V-belt or direct drives, access sections where indicated, mixing box or filter-mixing box, vibration-isolators, and appurtenances required for specified operation. Provide vibration

isolators as indicated. Physical dimensions of each air handling unit must be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

2.10.1.1 Casings

Provide the following:

a. Casing sections 2 inch double wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with door handles. Removal must not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Provide rigid doors with heavy duty hinges and latches. Inspection doors must be a minimum 12 inches wide by 12 inches high. Access doors must be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge stainless steel conforming to ASTM A167, Type 304, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils must not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Provide coils that are individually removable from the casing.

e. Casing insulation that conforms to NFPA 90A. Insulate single-wall casing sections handling conditioned air with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Insulate double-wall casing sections handling conditioned air with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Seal double wall insulation completely by inner and outer panels.

f. Factory applied fibrous glass insulation that conforms to ASTM C1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling

unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.

g. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections where indicated.

2.10.1.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.10.1.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.1.4 Fans

Provide the following:

a. Fans that are direct-drive plenum type. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.

b. Where fan arrays are scheduled, provide multiple plenum fans with direct drive motors. Fans shall operate together at the same speed to produce required air flow.

c. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide bearings that are permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

d. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Design belt drives for not less than a 1.3 service factor based on motor nameplate rating.

e. Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with totally enclosed enclosures.

f. Motor starters of magnetic reduced-voltage-start type with general-purpose enclosure. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as

indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260 I-P.

2.10.1.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.11 ULTRA VIOLET GERMICIDAL IRRADIATION (UVGI SYSTEM)

Provide a UVGI system installed downstream of the cooling coil of each air handling unit.

The UVC fixture and lamp assemblies shall be factory assembled and tested. They shall consist of a Housing, Power Supply, Lamp Socket, Lamp, Mounting Extrusion, Power Module and Extrusion Mounting Bracket and shall be constructed to withstand HVAC environments. Fixtures shall be UL/C-UL Listed under ABQK Classifications and provide for unobstructed 360 degrees UVC irradiance from the lamp to surfaces and the airstream.

The Housing shall be constructed of stainless steel in a UL drip-proof design that is equipped with mounting tabs to facilitate housing positioning and fastening anywhere on the Mounting Extrusion's four sides. Power to each fixture shall be from UL approved "plug and light" power service from the Mounting Extrusion Raceway. The Housing accommodates the Lamp Socket internally to prevent Lamp pin exposure to the airstream. The Housing incorporates all components into one integral assembly to maximize Lamp serviceability and to allow for 360 degree UVC irradiance from the Lamp to surfaces and the airstream.

The Power Supply shall be a Class 2, rapid start type electronic power supply that includes RF and EMI suppression. Each shall be supplied with power via a factory supplied Mounting Extrusion Raceway that is equipped with a UL approved and NEC compliant Power Module. The Power Supply maximizes photon production, radiance and reliability and shall be UL Listed for cold and/or moving airstreams of 55-135 degree Fm and 1000 fpm. Power requirements shall be 120 Vac.

The Lamp Socket shall be constructed if UVC resistant, commercial grade HVAC materials designed for long service. They shall be protected from the air stream, enclosed in the housing. The Lamp Socket accommodates a lamp to provide 360 degrees F UVC irridance to surfaces and the airstream.

The Lamp shall be a very high output, wind chill resistant, 60-Watt, T5 diameter, hot cathode, and twin tube bi-axial type equipped with a four-pin lamp base that is fully encapsulated when inserted into the Lamp Socket. The Lamp shall produce no less than 80 percent of its initial UVC output at its end of lamp life, or after 9000 hours of service. Each Lamp shall contain no more than 5.0 milligrams of mercury. Each lamp shall produce its specified output at 500 fpm in temperatures of 55-135 degrees F. The Lamp shall not produce ozone, fumes or any other contamination.

The Mounting Extrusion shall be a UL Listed and constructed of anodized, 6463-T5 aluminum extrusion to withstand HVAC environments and to accommodate the fixture on any of its four sides. It shall be designed with covered Power Raceways to provide A/C power to each Power Supply

connected to any of its four sides. The Mounting Extrusion and Power Raceway Covers shall be able to be field cut-to-length to accommodate any plenum height.

The Power Module shall be a UL Listed and constructed of stainless steel. It shall be equipped with mounting tabs to facilitate fastening to any of the Mounting Extrusion's four sides.

The Power Module shall distribute power to each Mounting Extrusion in accordance with electrical codes.

The Mounting Bracket shall be constructed of stainless steel and designed to accommodate, hold and fasten the Mounting Extrusion to the plenum or duct base.

The UVC system shall be tested to verify specified performance and conformity to UL/C-UL as to Category Code ABQK (Accessories, Air Duct Mounted) and UL Standards: 153, 1598 & 1995 respectively.

A Safety Switch shall be installed to shut the UVGI system off while the associated access doors are opened. Once access doors are closed, UVGI system shall turn back on automatically.

A UVGI system caution sign shall be provided and installed on all access doors associated with this system.

2.12 TERMINAL UNITS

2.12.1 Variable Air Volume (VAV) Terminal Units

a. Provide VAV terminal units that are the type, size, and capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.

b. Provide unit enclosures that are constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools. Provide reheat coils as indicated.

c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to AHRI 880 I-P with the calculations prepared in accordance with AHRI 885. Provide sound power level as indicated. Show discharge sound power for minimum and 1-1/2 inches water gauge inlet static pressure. Provide acoustical lining according to NFPA 90A.

2.12.1.1 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Provide units with an internal resistance not exceeding 0.4 inch water gauge at

maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 1 inch water gauge range.

2.12.1.2 Reheat Units

2.12.1.2.1 Hot Water Coils

Provide fin-and-tube type hot-water coils constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Provide headers that are constructed of cast iron, welded steel or copper. Provide casing and tube support sheets that are 16 gauge, galvanized steel, formed to provide structural strength. Provide tubes that are correctly circuited for proper water velocity without excessive pressure drop and are drainable where required or indicated. At the factory, test each coil at not less than 250 psi air pressure and provide coils suitable for 200 psi working pressure. Install drainable coils in the air handling units with a pitch of not less than 1/8 inch per foot of tube length toward the drain end. Coils must conform to the provisions of AHRI 410.

2.13 UNIT HEATERS

Heaters shall be as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

2.13.1 Propeller Fan Unit Heaters

Heaters shall be designed for suspension and arranged for horizontal discharge of air as indicated. Casings shall be not less than 20 gauge steel and finished with lacquer or enamel. Suitable stationary deflectors shall be provided to assure proper air and heat penetration capacity at floor level based on established design temperature. Suspension from heating pipes will not be permitted.

2.13.2 Water Heating Coils

Heating coils and radiating fins shall be of suitable non-ferrous alloy with threaded or bronzed fittings at each end for connecting to external piping. The heating elements shall be free to expand or contract without developing leaks and shall be properly pitched for drainage. The elements shall be tested under a hydrostatic pressure of 200 psig and a certified report of the test shall be submitted to the Contracting Officer. Coils shall be suitable for use with water up to 250 degrees F.

2.13.3 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.13.4 Motor Switches

Motors shall be provided with manual selection switches with "Off," and "Automatic" positions and shall be equipped with thermal overload protection.

2.13.5 Controls

Controls shall be provided as specified in Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

2.14 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

Field paint factory painting that has been damaged prior to acceptance by the Contracting Officer in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.15 SUPPLEMENTAL COMPONENTS/SERVICES

2.15.1 Chilled and Heating Water Piping

The requirements for chilled and heating water piping and accessories are specified in Section 23 64 26 CHILLED AND HEATING WATER PIPING SYSTEMS.

2.15.2 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.15.3 Controls

The requirements for controls are specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC, Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices)and the National Electrical Safety Code (NESC).

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS.

3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.2.6 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.7 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit. Externally insulate exhaust and relief air ducts and plenums from exterior to the motorized or backdraft damper.

3.2.8 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.9 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 28 calendar days before being loaded. Provide higher equipment pad height as required by equipment drain trap seal piping.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

3.6.1 Sleeves

Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.

3.6.2 Framed Prepared Openings

Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

3.6.3 Insulation

Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

3.6.4 Closure Collars

Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for

round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

3.7.1 Temperatures less than 120 degrees F

Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures less than 120 degrees F.

3.7.2 Finish Painting

The requirements for finish painting of items only primed at the factory, and surfaces not specifically noted otherwise, are specified in Section 09 90 00 PAINTS AND COATINGS.

3.7.3 Color Coding Scheme for Locating Hidden Utility Components

Use scheme in buildings having suspended grid ceilings. Provide color coding scheme that identifies points of access for maintenance and operation of components and equipment that are not visible from the finished space and are accessible from the ceiling grid, consisting of a color code board and colored metal disks. Make each colored metal disk approximately 3/8 inch diameter and secure to removable ceiling panels with fasteners. Insert each fastener into the ceiling panel so as to be concealed from view. Provide fasteners that are manually removable without the use of tools and that do not separate from the ceiling panels when the panels are dropped from ceiling height. Make installation of colored metal disks follow completion of the finished surface on which the disks are to be fastened. Provide color code board that is approximately 3 foot wide, 30 inches high, and 1/2 inches thick. Make the board of wood fiberboard and frame under glass or 1/16 inch transparent plastic cover. Make the color code symbols approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. Mount the color code board in the mechanical or equipment room.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all

valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TEST

Perform ductwork leak test for air distribution and exhaust system, including fans where indicated on the drawings. Provide test procedure, apparatus, and report that conform to SMACNA 1972 CD. Complete ductwork leak test with satisfactory results prior to applying insulation to ductwork exterior or concealing ductwork. The requirements for ductwork leak tests are specified in Section 23 05 93.00 06 TESTING, ADJUSTING AND BALANCING OF HVAC.

3.10 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93.00 06 TESTING, ADJUSTING AND BALANCING OF HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 PERFORMANCE TESTS

Conduct performance tests as required in Section 23 05 93.00 06 TESTING, ADJUSTING AND BALANCING OF HVAC and Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

3.12.1 Start-Up Test

Perform startup tests for all scheduled equipment to ensure that the equipment and components are installed and functioning. Follow start-up procedures as documented by the equipment manufacturer and as coordinated with the commissioning agency.

3.12.2 Start-Up Reports

Submit report documenting the results of the tests performed and certifying that the system is installed and functioning per the specifications, and is ready for the Performance Verification Test (PVT).

3.13 CLEANING AND ADJUSTING

Provide a temporary bypass for water coils to prevent flushing water from passing through coils. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all

fans that are operated during construction, and provide new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Perform and document that proper "Indoor Air Quality During Construction" procedures have been followed; provide documentation showing that after construction ends, and prior to occupancy, new filters were provided and installed. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 Operation And Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 16 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 64 26

CHILLED AND HEATING WATER PIPING SYSTEMS
08/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(2015) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2018) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2016) 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 B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B31.9	(2017) Building Services Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing

Qualifications

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals 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	(2012) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2019a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A733	(2016) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B42	(2015a) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88	(2016) Standard Specification for Seamless Copper Water Tube
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	(2022) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F1199	(1988; R 2015) Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 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 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems

1.2 SYSTEM DESCRIPTION

Provide the water systems having the minimum service (design) temperature-pressure rating indicated. Provision of the piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the required and advisory provisions of ASME B31.9 except as modified or supplemented by this specification section or design drawings. This specification section covers the water systems piping which is located within, on, and adjacent to building(s) within the building(s) 5 foot line.

Submit Coordination Drawings for pipes, valves and specialties showing coordination of work between different trades and with the structural and architectural elements of work. Detail all drawings sufficiently to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate on drawings where conflicts or clearance problems exist between various trades. Show radiant heating system header piping details and tubing keyouts.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Coordination Drawings; G

SD-03 Product Data

Piping and Fittings; G

Valves; G

Calibrated Balancing Valves; G

Pressure Relief Valve; G

Combination Pressure and Temperature Relief Valves; G

Expansion Joints; G

SD-06 Test Reports

Piping Welds NDE Report

Pressure Tests Reports; G

Report shall be provided in bound 8-1/2 by 11 inch booklets. In the reports, document all phases of the tests performed. Include initial test summaries, all repairs/adjustments made, and the final test results.

SD-07 Certificates

Employer's Record Documents (For Welding)

Welding Procedures and Qualifications

SD-10 Operation and Maintenance Data

Requirements for data packages are specified Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified by this specification section.

Submit spare parts data for each different item of equipment specified, with operation and maintenance data packages. Include 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.

Submit a list of qualified permanent service organizations with operation and maintenance data packages. Include service

organization addresses and service area or expertise. The service organizations shall 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.

Calibrated Balancing Valves, Data Package 3; G

Pressure Relief Valve, Data Package 2; G

Combination Pressure and Temperature Relief Valves, Data Package 2; G

Expansion Joints, Data Package 2; G

1.4 MODIFICATIONS TO REFERENCES

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 SAFETY REQUIREMENTS

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 shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.6 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 shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, cap piping and

similar openings to keep out dirt and other foreign matter. Any porous materials found to be contaminated with mold or mildew will be replaced at the Contractor's expense. Non-porous materials found to be contaminated with mold or mildew will be disinfected and cleaned prior to installation.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.7.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.7.3 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be 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 shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall 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 shall 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. System components shall be environmentally suitable for the indicated locations.

The equipment items shall be supported by service organizations. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 STEEL PIPING

Water piping shall be steel pipe or copper tubing. Provide steel piping

with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.2.1 Pipe

Steel pipe, conform to ASTM A106/A106M, Schedule 40, Grade B, or ASTM A53/A53M, Schedule 40, Type E or S, Grade B. Do not use Type F pipe.

2.2.2 Fittings and End Connections (Joints)

Piping and fittings 2 inch and smaller shall have threaded connections. Piping and fittings 2-1/2 inches and larger shall have welded or flanged connections. The manufacturer of each fitting shall be permanently identified on the body of the fitting in accordance with MSS SP-25.

2.2.2.1 Threaded Connections

Use threaded valves and pipe connections conforming to ASME B1.20.1. Used threaded fitting conforming to ASME B16.3. Use threaded unions conforming to ASME B16.39. Use threaded pipe nipples conforming to ASTM A733.

2.2.2.2 Flanged Connections

Flanges shall conform to ASME B16.1, Class 125. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. These gaskets shall contain aramid fibers bonded with styrene butadeine rubber (SBR) or nitrile butadeine rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.1.

2.2.2.3 Welded Connections

Welded valves and pipe connections (both butt-welds and socket-welds types) shall conform to ASME B31.9. Butt-welded fittings shall conform to ASME B16.9. Socket-welded fittings shall conform to ASME B16.11. Welded fittings shall be identified with the appropriate grade and marking symbol.

2.2.2.4 Dielectric Waterways and Flanges

Provide dielectric waterways with a water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test. Provide dielectric waterways constructed of galvanized steel and have threaded end connections to match connecting piping. Dielectric waterways shall be suitable for the required operating pressures and temperatures. Provide dielectric flanges with the same pressure ratings as standard flanges and provide complete electrical isolation between connecting pipe and/or equipment as described herein for dielectric waterways.

2.3 COPPER TUBING

Provide copper tubing and fittings with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.3.1 Tube

Use copper tube conforming to ASTM B88, Type L or M for aboveground tubing, and Type K for buried tubing.

2.3.2 Fittings and End Connections (Solder and Flared Joints)

Wrought copper and bronze solder joint pressure fittings, including unions ands flanges, shall conform to ASME B16.22 and ASTM B75/B75M. Provide adapters as required. Cast copper alloy solder-joint pressure fittings , including unions and flanges, shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. ASTM B42 copper pipe nipples with threaded end connections shall conform to ASTM B42.

Copper tubing of sizes larger than 4 inches shall have 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.

Extracted brazed tee joints may not be used.

2.3.3 Solder

Provide solder in conformance with ASTM B32, grade Sb5, tin-antimony alloy. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B813.

2.3.4 Brazing Filler Metal

Filler metal shall conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

2.4 VALVES

Provide valves with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

Valves in insulated piping shall have 2 inch extended stems.

2.4.1 Gate Valve

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 Class 125 and shall be bronze with wedge disc, rising stem and threaded, soldered, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70, Class 125, cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.4.2 Globe and Angle Valve

Globe and angle valves 2-1/2 inches and smaller shall conform to MSS SP-80, Class 125. Globe and angle valves 3 inches and larger shall conform to MSS SP-85, Class 125.

2.4.3 Check Valve

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80. Check valves 3 inches and larger shall conform to MSS SP-71, Class 125.

2.4.4 Ball Valve

Ball valves shall conform to MSS SP-72 for Figure ID, three piece body and shall be rated for service at not less than 175 psig at 200 degrees F.

Valve bodies in sizes 2 inches and smaller shall be screwed-end connection-type constructed of Class A copper alloy. Balls and stems of valves 2 inches and smaller shall be manufacturer's standard with hard chrome plating finish. Balls and stems of valves 2-1/2 inches and larger shall be manufacturer's standard Class C corrosion-resistant steel alloy with hard chrome plating. Balls of valves 6 inches and larger may be Class D with 900 Brinell hard chrome plating. Valves shall be suitable for flow from either direction and shall seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. All valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

2.4.5 Calibrated Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts. Provide valve calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Valve shall have an integral pointer which registers the degree of valve opening. Valve shall function as a service valve when in fully closed position. Valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation.

Provide valve bodies with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable differential pressure meter connections to verify the pressure differential. Provide metal tag on each valve showing the gallons per minute flow for each differential pressure reading.

2.4.6 Pressure Relief Valve

Valve shall prevent excessive pressure in the piping system when the piping system reaches its maximum heat buildup. Valve, ANSI Z21.22/CSA 4.4 and shall have cast iron bodies with corrosion resistant internal working parts. The discharge pipe from the relief valve shall be the size of the valve outlet unless otherwise indicated.

2.4.7 Combination Pressure and Temperature Relief Valves

ANSI Z21.22/CSA 4.4, copper alloy body, automatic re-seating, test lever, and discharge capacity based on AGA temperature steam rating.

2.4.8 Drain Valves

Valves, MSS SP-80 gate valves. Valve shall be manually-operated, 3/4 inch pipe size and above with a threaded end connection. Provide valve with a water hose nipple adapter. Freeze-proof type valves shall be provided in installations exposed to freezing temperatures.

2.4.9 Air Venting Valves

Manually-operated general service type air venting valves, brass or bronze valves that are furnished with threaded plugs or caps. Automatic type air venting shall be the ball-float type with brass/bronze or brass bodies, 300 series corrosion-resistant steel float, linkage and removable seat. Air venting valves on water coils shall have not less than 1/8 inch threaded end connections. Air venting valves on water mains shall have not less than 3/4 inch threaded end connections. Air venting valves on all other applications shall have not less than 1/2 inch threaded end

connections.

2.4.10 Vacuum Relief Valves

ANSI Z21.22/CSA 4.4.

2.5 PIPING ACCESSORIES

2.5.1 Strainer

Strainer, ASTM F1199, except as modified and supplemented in this specification. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. Strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. The bodies shall have arrows clearly cast on the sides indicating the direction of flow.

Provide strainer with removable cover and sediment screen. The screen shall be made of minimum 22 gauge brass sheet, monel, or stainless steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.5.2 Pressure and Vacuum Gauges

Gauges, ASME B40.100 with throttling type needle valve or a pulsation dampener and shut-off valve. Provide gauges with 4.5 inch dial, brass or aluminum case, bronze tube, and siphon. Gauge shall have a range from 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.5.3 Temperature Gauges

Temperature gauges, shall be the industrial duty type and be provided for the required temperature range. Provide gauges with fixed thread connection, dial face gasketed within the case; and an accuracy within 2 percent of scale range. Gauges shall have Fahrenheit scale in 2 degree graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 5 feet of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 5 to 7 feet above the finished floor or in locations indicated. Remote element type temperature gauges shall be provided in thermal wells located 7 feet above the finished floor or in locations indicated.

2.5.3.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.5.3.2 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and

connecting capillary tubing shall be double-braided bronze.

2.5.3.3 Thermal Well

Thermal well shall 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 shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

2.5.4 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports: To MSS SP-58. If ferrous materials are utilized provide hot-dipped galvanized hangers, inserts and supports.

2.5.5 Escutcheons

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Secure plates in place by internal spring tension or set screws. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.6 FACTORY APPLIED INSULATION

Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 25 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 shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E84.

Insulation shall 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 shall be tested as a composite material. Jackets, facings, and adhesives shall 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.

2.7 RELATED COMPONENTS/SERVICES

2.7.1 Field Applied Insulation

Requirements for field installed insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as supplemented and modified by this specification section.

PART 3 EXECUTION

3.1 INSTALLATION

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 burrs by reaming, and fashion to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.1.1 Welding

Provide welding work specified this section for piping systems in conformance with ASME B31.9, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: Qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

3.1.1.1 Employer's Record Documents (For Welding)

Submit for review and approval the following documentation. This documentation and the subject qualifications shall be in compliance with ASME B31.9.

a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.

b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.

c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

3.1.1.2 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

3.1.1.3 Examination of Piping Welds

Conduct non-destructive examinations (NDE) on piping welds and brazing and verify the work meets the acceptance criteria specified in ASME B31.9.

NDE on piping welds covered by ASME B31.9 is visual inspection only. Submit a piping welds NDE report meeting the requirements specified in ASME B31.9.

3.1.1.4 Welding Safety

Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

3.1.2 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 shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.

3.1.3 Functional Requirements

Pitch horizontal supply mains down in the direction of flow as indicated. The grade shall not be less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Cap or plug open ends of pipelines and equipment during installation to keep dirt or other foreign materials out of the system.

Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches and above in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric waterways or flanges.

Piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Electric isolation fittings shall be provided between dissimilar metals.

3.1.4 Fittings and End Connections

3.1.4.1 Threaded Connections

Threaded connections shall be made with tapered threads and made tight with PTFE tape complying with ASTM D3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

3.1.4.2 Brazed Connections

Brazing, AWS BRH, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Piping shall be

supported prior to brazing and not be sprung or forced.

3.1.4.3 Welded Connections

Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.9. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.4.4 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.4.5 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for the intended application.

3.1.5 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.6 Air Vents

Air vents shall be provided at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

3.1.7 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.8 Flexible Pipe Connectors

Connectors shall be attached to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.9 Temperature Gauges

Temperature gauges shall be located on coolant supply and return piping at each heat exchanger, on condenser water piping entering and leaving a condenser, at each automatic temperature control device without an integral thermometer, and where indicated or required for proper operation of equipment. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 1 inch.

3.1.10 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58, except as supplemented and modified in this specification section. Pipe hanger types 5, 12, and 26 shall not be used. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.10.1 Hangers

Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.1.10.2 Inserts

Type 18 inserts shall be secured 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.

3.1.10.3 C-Clamps

Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.1.10.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

3.1.10.5 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, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

3.1.10.6 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 50 pounds shall have

the excess hanger loads suspended from panel points.

3.1.10.7 Vertical Pipe Supports

Vertical pipe shall be supported 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.

3.1.10.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.1.10.9 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, a Type 39 saddle shall be used. 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.

3.1.10.10 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.10.11 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section.

3.1.11 Pipe Alignment Guides

Pipe alignment guides shall be provided 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.

3.1.12 Pipe Anchors

Anchors shall be provided where indicated. Unless indicated otherwise, anchors shall comply with the requirements specified. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required.

Supports, anchors, or stays shall not be attached 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, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.

3.1.13 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Except as indicated otherwise piping sleeves shall comply with requirements specified. Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A53/A53M, Standard weight. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

3.1.13.1 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide 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, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

3.1.13.2 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a 0.17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange.

Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

a. 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. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange, a modular mechanical type sealing assembly may be installed. Seals shall consist 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. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.

After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.1.13.3 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.1.14 Access Panels

Access panels shall be provided where indicated for all concealed valves, vents, controls, and additionally for items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

3.2 ELECTRICAL INSTALLATION

Install electrical equipment in accordance with NFPA 70 and manufacturers instructions.

3.3 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4 FIELD TESTS

Field tests shall be conducted in the presence of the QC Manager or his designated representative to verify systems compliance with specifications. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor.

3.4.1 Equipment and Component Isolation

Prior to testing, equipment and components that cannot withstand the tests shall be properly isolated.

3.4.2 Pressure Tests

Each piping system , except for polypropylene piping, shall be hydrostatically tested at a pressure not less than 188 psig for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Test pressure shall be monitored by a currently calibrated test pressure gauge. Leaks shall be repaired and piping retested until test requirements are met. No leakage or reduction in gage pressure shall be allowed.

Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before concealing.

Submit for approval pressure tests reports covering the above specified piping pressure tests; describe the systems tested, test results, defects found and repaired, and signature of the pressure tests' director. Obtain approval from the QC Manager before concealing piping or applying insulation to tested and accepted piping.

3.4.3 Related Field Inspections and Testing

3.4.3.1 Piping Welds

Examination of Piping Welds is specified in the paragraph EXAMINATION OF PIPING WELDS (above).

3.4.3.2 HVAC TAB

Requirements for testing, adjusting, and balancing (TAB) of HVAC water piping, and associated equipment is specified in Section 23 05 93.00 06 TESTING, ADJUSTING, AND BALANCING OF HVAC. Coordinate with the TAB team, and provide support personnel and equipment as specified in Section 23 05 93.00 06 TESTING, ADJUSTING AND BALANCING OF HVAC to assist TAB team to meet the TAB work requirements.

-- End of Section --

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SECTION 25 10 10

ENERGY MONITORING AND CONTROL SYSTEM (EMCS) FRONT END AND INTEGRATION
02/19

PART 1 GENERAL

1.1 SUMMARY

Provide a Energy Monitoring and Control System (EMCS) which performs supervisory monitoring and supervisory control of building control systems and utility control systems using ASHRAE 135 (BACnet). Integrate ASHRAE 135 (BACnet) field control systems installed per Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS as specified.

1.1.1 System Requirements

Provide a EMCS as specified and indicated, and in accordance with the following characteristics:

1.1.1.1 Compatibility

Provide systems compatible Honeywell Comfort Point Open Studio BACnet in order to integrate into Ellsworth's Honeywell EBI R500 or newer front end.

1.1.1.2 General System Requirements

a. The system shall be integrated into the Base wide system. Integration shall be performed by the Contractor.

b. The system performs supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.

c. The system includes a Graphical User Interface which allows for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, and access to all supervisory monitoring and control functions.

d. All software used by the EMCS and all software used to install and configure the EMCS is licensed to and delivered to the installation. All licensing costs shall be included by the Contractor.

e. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software is licensed to and otherwise remains with the Government such that the Government or their agents are able to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor. Software licenses must not require periodic fees and must be valid in perpetuity.

f. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to repair, replace, upgrade, and expand the system

without subsequent or future dependence on the Contractor.

g. The EMCS interfaces directly to ASHRAE 135, CEA-709.1-D, MODBUS Protocol, MODBUS TCP/IP, OPC DA, and Niagara Framework field control systems as specified and may interface to field control systems using other protocols via an M&C Software protocol driver or a Gateway.

h. For EMCS systems with Monitoring and Control Software functionality implemented in Monitoring and Control (M&C) Controller Hardware, provide sufficient additional controller hardware to support the full capacity requirements as specified.

1.1.1.3 BACnet Requirements

a. The EMCS must communicate using ASHRAE 135 Annex J over an IP network as specified.

b. All communication between the EMCS and ASHRAE 135 field control networks must be via the ASHRAE 135 protocol over the IP network.

c. All communication between the M&C Software and the field control system devices must be via standard ASHRAE 135 services other than PrivateTransfer and ConfirmedPrivateTransfer except as follows:

(1) PrivateTransfer and ConfirmedPrivateTransfer may be used for device configuration and device programming.

(2) PrivateTransfer and ConfirmedPrivateTransfer may be used for communication between the M&C Software and the field control system if and only if both the M&C Software and the field control system devices automatically (without requiring reconfiguration) revert to the use of other standard ASHRAE 135 services when one of the components is modified or replaced.

1.1.2 General Cybersecurity Requirements

Address cybersecurity in accordance with AF ETL 11-1.

1.1.3 Symbols, Definition and Abbreviations

Use symbols, definitions, and engineering unit abbreviations indicated in the contract drawings for displays, submittals and reports. For symbols, definitions and abbreviations not in the contract drawings use terms conforming at a minimum to IEEE Stds Dictionary and the ASHRAE FUN IP, as applicable.

1.1.4 System Units and Accuracy

Use English (inch-pound) units for displays, print-outs and calculations. Perform calculations with an accuracy of at least three significant figures. For displays and printouts present values to at least three significant figures.

1.1.5 Data Packages/Submittals Requirements

Technical data packages consisting of computer software and technical data (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required

in other specifications must be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered must be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered shop drawings under the Federal Acquisition Regulation Supplement (FARS) and must contain no proprietary information and must be delivered with unrestricted rights.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2016) BACnet—A Data Communication Protocol for Building Automation and Control Networks
ASHRAE FUN IP	(2017) Fundamentals Handbook, I-P Edition

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification
CEA-852-C	(2014) Tunneling Device Area Network Protocols Over Internet Protocol Channels

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1815	(2015; CORR 2016) Exchanging Information Between Networks Implementing IEC 61850 and IEEE Std 1815 Distributed Network Protocol (DNP3)
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNET ENGINEERING TASK FORCE (IETF)

IETF RFC 7465	(2015) Prohibiting RC4 Cipher Suites
RFC 821	(2001) Simple Mail Transfer Protocol (SMTP)

LONMARK INTERNATIONAL (LonMark)

LonMark Interoperability Guide	(2005) LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4
LonMark SNVT List	(2014) LonMark SNVT Master List; Version 15

LonMark XIF Guide	(2001) LonMark External Interface File Reference Guide; Revision 4.402

MODBUS ORGANIZATION, INC (MODBUS)

MODBUS Protocol	(2012) Modbus Application Protocol Specification; Version 1.1b3
MODBUS TCP/IP	(2006) Modbus Messaging on TCP/IP Implementation Guide; Version V1.0b

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 262	(2019) Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

OPC FOUNDATION (OPC)

OPC DA	(Ver 3.0; Errata) OPC Data Access (DA)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

TRIDIUM, INC (TRIDIUM)

Niagara Framework	(2012) NiagaraAX User's Guide

U.S. AIR FORCE (USAF)

AF ETL 11-1	(2011) Civil Engineer Industrial Control System Information Assurance Compliance

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC EMC	(2002) FCC Electromagnetic Compliance Requirements
FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 1778	(2014; Reprint Sep 2017) UL Standard for Safety Uninterruptible Power Systems
UL 60950	(2000; Reprint Oct 2007) Safety of Information Technology Equipment

1.3 DEFINITIONS

The following list of definitions may contain terms not found elsewhere in this Section but are included here for completeness. Some terms are followed with a protocol reference in parenthesis indicating to which protocol the term and definition applies. Inclusion of protocol-specific definitions does not create a requirement to support that protocol, nor does it relax any requirements to support specific protocols as indicated elsewhere in this section.

1.3.1 Alarm Generation

The process of comparing a point value (the point being alarmed) with a pre-defined alarm condition (e.g., a High Limit) and performing some action based on the result of the comparison.

1.3.2 Alarm Handling

See Alarm Routing.

1.3.3 Alarm Routing

Alarm routing is M&C software functionality that starts with a notification that an alarm exists (typically as the output of an Alarm Generation process) and sends a specific message to a specific alarm recipient or device.

1.3.4 Application Generic Controller (AGC)(LonWorks)

A device that is furnished with a (limited) pre-established application that also has the capability of being programmed. Further, the ProgramID and XIF file of the device are fixed. The programming capability of an AGC may be less flexible than that of a General Purpose Programmable Controller (GPPC).

1.3.5 Application Specific Controller (ASC)(LonWorks)

A device that is furnished with a pre-established built in application that is configurable but not re-programmable. An ASC has a fixed factory-installed application program (i.e., Program ID) with configurable settings.

1.3.6 BACnet (BACnet)

The term BACnet is used in two ways. First meaning the BACnet Protocol Standard - the communication requirements as defined by ASHRAE 135 including all annexes and addenda. The second to refer to the overall technology related to the ASHRAE 135 protocol.

1.3.7 BACnet Advanced Application Controller (B-AAC)(BACnet)

A hardware device BTL Listed as a B-AAC. A control device which contains BIBBs in support of scheduling and alarming but otherwise has limited resources relative to a B-BC. It may be intended for specific applications and supports some degree of programmability.

1.3.8 BACnet Advanced Operator Workstation (B-AWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as an Advanced Operator Workstation and includes the ability to manage scheduling, alarming and trending in an open manner. The B-AWS is the advanced operator's window into a BACnet system. It is primarily used to monitor the performance of a system and to modify parameters that affect the operation of a system.

1.3.9 BACnet Application Specific Controller (B-ASC)(BACnet)

A hardware device BTL Listed as a B-ASC. A controller with limited resources relative to a B-AAC. It is intended for use in a specific application and supports limited programmability.

1.3.10 BACnet Building Controller (B-BC)(BACnet)

A hardware device BTL Listed as a B-BC. A general-purpose, field-programmable device capable of carrying out a variety of building automation and control tasks including control and monitoring via direct digital control (DDC) of specific systems and data storage for trend information, time schedules, and alarm data. Like the other BTL Listed controller types (B-AAC, B-ASC etc.) a B-BC device is required to support the server ("B") side of the ReadProperty and WriteProperty services, but unlike the other controller types it is also required to support the client ("A") side of these services. Communication between controllers requires that one of them support the client side and the other support the server side, so a B-BC is often used when communication between controllers is needed.

1.3.11 BACnet Internetwork (BACnet)

Two or more BACnet networks connected with BACnet routers. In a BACnet Internetwork, there exists only one message path between devices.

1.3.12 BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more BACnet services intended to define a higher level of interoperability. BIBBs are combined to build the BACnet functional requirements for a device in a specification. Some BIBBs define additional requirements (beyond requiring support for specific services) in order to achieve a level of interoperability. For example, the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by an M&C client, not only requires the client to support the ReadProperty Service, but also provides a list of data types (Object / Properties) which the client must be able to interpret and display for the user.

1.3.13 BACnet Operator Display (B-OD)(BACnet)

A hardware device BTL Listed as a B-OD. A basic operator interface with limited capabilities relative to a B-OWS. It is not intended to perform direct digital control. The B-OD profile could be used for wall-mounted LCD devices, displays affixed to BACnet devices; hand-held terminals or

other very simple user interfaces.

1.3.14 BACnet Operator Workstation (B-OWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as a B-OWS. An operator interface with limited capabilities relative to a B-AWS. The B-OWS is used for monitoring and basic control of a system, but differs from a B-AWS in that it does not support configuration activities, nor does it provide advanced troubleshooting capabilities.

1.3.15 BACnet Smart Actuator (B-SA)(BACnet)

A hardware device BTL Listed as a B-SA. A simple control output device with limited resources; it is intended for specific applications.

1.3.16 BACnet Smart Sensor (B-SS)(BACnet)

A hardware device BTL Listed as a B-SS. A simple sensing device with very limited resources.

1.3.17 BACnet Testing Laboratories (BTL)(BACnet)

Established by BACnet International to support compliance testing and interoperability testing activities and consists of BTL Manager and the BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.3.18 BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been certified by BACnet® Testing Laboratory. Devices may be certified to a specific device profile, in which case the certification indicates that the device supports the required capabilities for that profile, or may be certified as "other".

1.3.19 Binary

A two-state system or signal; for example one where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

1.3.20 Broadcast

Unlike most messages, which are intended for a specific recipient device, a broadcast message is intended for all devices on the network.

1.3.21 Building Control Network (BCN)

The network used by the Building Control System. Typically the BCN is a BACnet ASHRAE 135 or LonWorks CEA-709.1-D network installed by the building control system contractor.

1.3.22 Building Control System (BCS)

One type of Field Control System. A control system for building electrical and mechanical systems, typically HVAC (including central plants) and lighting. A BCS generally uses Direct Digital Control (DDC) Hardware and generally does NOT include its own local front end.

1.3.23 Building Point of Connection (BPOC)

A FPOC for a Building Control System. (This term is being phased out of use in preference for FPOC but is still used in some specifications and criteria. When it was used, it typically referred to a piece of control hardware. The current FPOC definition typically refers instead to IT hardware).

1.3.24 Commandable (BACnet)

A point (Object) is commandable if its Present_Value Property is writable and it supports the optional Priority_Array Property. This functionality is useful for Overrides.

1.3.25 Configuration Property (LonWorks)

Controller parameter used by the application which is usually set during installation/testing and seldom changed. For example, the P and I settings of a P-I control loop. Also see 'Standard Configuration Property Type (SCPT)'.

1.3.26 Control Logic Diagram

A graphical representation of control logic for multiple processes that make up a system.

1.3.27 Device Object (BACnet)

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object_Identifier number on the BACnet Internetwork. This number is often referred to as the device instance or device ID.

1.3.28 Explicit Messaging (LonWorks)

A non-standard and often vendor (application) specific method of communication between devices.

1.3.29 Field Point Of Connection (FPOC)

The FPOC is part of the EMCS IP network and acts as the point of connection between the EMCS IP Network and the field control IP network. The FPOC is an IT device such as a switch, IP router, or firewall, typically managed by the site IT staff. (Note that the field control IP network may consist of a single IP device, or that integration may require installation of a field control network IP device.)

1.3.30 Field Control Network

The network used by a field control system.

1.3.31 Field Control System (FCS)

A building control system or utility control system.

1.3.32 Fox Protocol (Niagara Framework)

The protocol used for communication between components in the Niagara Framework. By default, Fox uses TCP port 1911.

1.3.33 Gateway

A device that translates from one protocol to another. Devices that change only the transport mechanism of the protocol - "translating" from LonWorks over TP/FT-10 to LonWorks over IP for example - are not gateways as the underlying protocol (data format) does not change. Gateways are also called Communications Bridges or Protocol Translators.

1.3.34 General Purpose Programmable Controller (GPPC) (LonWorks)

Unlike an ASC or AGC, a GPPC is not furnished with a fixed application program and does not have a fixed ProgramID or XIF file. A GPPC can be (re-)programmed, usually using vendor-supplied software. When a change to the program affects the external interface (and the XIF file) the ProgramID will change.

1.3.35 Internetwork (BACnet)

See BACnet Internetwork.

1.3.36 JACE (Niagara Framework)

Java Application Control Engine. See Niagara Framework Supervisory Gateway.

1.3.37 LonWorks (LonWorks)

The term used to refer to the overall technology related to the CEA-709.1-D protocol (sometimes called "LonTalk"), including the protocol itself, network management, interoperability guidelines and products.

1.3.38 Modbus

A basic protocol for control network communications generally used in utility control systems. The Modbus protocol standard is maintained by The Modbus Organization.

1.3.39 Master-Slave/Token Passing (MS/TP)(BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds (data rates) are permitted by the BACnet MS/TP standard.

1.3.40 Monitoring and Control (M&C) Software

The EMCS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

1.3.41 Network (BACnet)

In BACnet, a portion of the control internetwork consisting of one or more segments of the same media connected by repeaters. Networks are separated by routers.

1.3.42 Network Variable (LonWorks)

See 'Standard Network Variable Type (SNVT)'.

1.3.43 Network Configuration Tool (LonWorks)

The software used to configure the control network and set device configuration properties. This software creates and modifies the control network database (LNS Database).

1.3.44 Niagara Framework

A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The Framework consists of front end (M&C) software, web based clients, field level control hardware, and engineering tools. While the Niagara Framework is not adopted by a recognized standards body and does not use an open licensing model, it is sufficiently well-supported by multiple HVAC vendors to be considered a de-facto Open Standard.

1.3.45 Niagara Framework Supervisory Gateway (Niagara Framework)

DDC Hardware component of the Niagara Framework. A typical Niagara architecture has Niagara specific supervisory gateways at the IP level and other (non-Niagara specific) controllers on field networks (TP/FT-10, MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara specific controllers function as a gateway between the Niagara framework protocol (Fox) and the field network beneath. These supervisory gateways may also be used as general purpose controllers and also have the capability to provide a web-browser based user interface.

Note that different vendors refer to this component by different names. The most common name is "JACE"; other names include "EC-BOS", "FX-40", and "UNC".

1.3.46 Node (LonWorks)

A device that communicates using the CEA-709.1-D protocol and is connected to a CEA-709.1-D network.

1.3.47 Object (BACnet)

A BACnet Object. The concept of organizing BACnet information into standard components with various associated Properties. Examples include Analog Input objects and Binary Output objects.

1.3.48 Override

To change the value of a point outside of the normal sequence of operation where this change has priority over the sequence. An override can be accomplished in one of two ways: The point itself may be Commandable and written to with a priority or there may be a separate point on the controller for the express purpose of implementing the override.

Typically this override is from the Energy Monitoring and Control System (EMCS) Monitoring and Control (M&C) Software. Note that this definition is not standard throughout industry.

1.3.49 Point, Calculated

A value within the M&C Software that is not a network point but has been calculated by logic within the software based on the value of network points or other calculated points. Calculated points are sometimes called

virtual points or internal points.

1.3.50 Point, Network

A value that the M&C Software reads from or writes to a field control network.

1.3.51 Polling

A requested transmission of data between devices, rather than an unrequested transmission such as Change-Of-Value (COV) or Binding where data is automatically transmitted under certain conditions.

1.3.52 Program ID (LonWorks)

An identifier (number) stored in the device (usually EEPROM) that identifies the node manufacturer, functionality of device (application & sequence), transceiver used, and intended device usage.

1.3.53 Property (BACnet)

A BACnet Property - a data element associated with an Object. Different Objects have different Properties, for example an Analog Input Object has a Present_Value Property (which provides the value of the underlying hardware analog input), a High_Limit Property (which contains a high limit for alarming), as well as other properties.

1.3.54 Protocol Implementation Conformance Statement (PICS)(BACnet)

A document, created by the manufacturer of a device, which describes which potions of the BACnet standard are implemented by a given device.

1.3.55 Repeater

A device that connects two control network segments and retransmits all information received on one side onto the other.

1.3.56 Router (BACnet)

A device that connects two or more BACnet networks and controls traffic between the networks by retransmitting signals received from one network onto another based on the signal destination. Routers are used to subdivide an internetwork and to control bandwidth usage.

1.3.57 Segment

A 'single' section of a control network that contains no repeaters or routers. There is generally a limit on the number of devices on a segment, and this limit is dependent on the topology/media and device type. For example, a TP/FT-10 segment with locally powered devices is limited to 64 devices, and a BACnet MS/TP segment is limited to 32 devices.

1.3.58 Service (BACnet)

A BACnet Service. A defined method for sending a specific type of data between devices. Services are always defined in a Client-Server manner, with a Client initiating a Service request and a Server Executing the Service. Some examples are ReadProperty (a client requests a data value from a server), WriteProperty (a client writes a data value to a server),

and CreateObject (a client requests that a server create a new object within the server device).

1.3.59 Standard BACnet Object/Property/Service (BACnet)

BACnet Objects, Properties, or Services that are standard Objects, Properties, or Services enumerated and defined in ASHRAE 135. Clause 23 of ASHRAE 135 defines methods to extend ASHRAE 135 to non-standard or proprietary information. Standard BACnet Objects/Properties/Services specifically exclude any vendor specific extensions.

1.3.60 Standard Network Variable Type (SNVT) (LonWorks)

Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e., it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

1.3.61 Supervisory Controller

A controller implementing a combination of supervisory logic (global control strategies or optimization strategies), scheduling, alarming, event management, trending, web services or network management. Note this is defined by use; many supervisory controllers have the capability to also directly control equipment.

1.3.62 Supervisory Gateway

A device that is both a supervisory controller and a gateway.

1.3.63 EMCS Network

An IP network connecting multiple field control systems to the Monitoring and Control Software using one or more of: LonWorks (CEA-709.1-D and CEA-852-C), BACnet (ASHRAE 135 Annex J), MODBUS Protocol, MODBUS TCP/IP or OPC DA.

1.3.64 Utility Control System (UCS)

One type of field control system. Used for control of utility systems such as an electrical substation, sanitary sewer lift station, water pump station, etc. Building controls are excluded from a UCS, however it is possible to have a Utility Control System and a Building Control System in the same facility, and for those systems to share components such as the FPOC. A UCS may include its own local front-end.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES and TABLE 1. PROJECT SEQUENCING:

SD-02 Shop Drawings

EMCS Contractor Design Drawings; G

EMCS Contractor Design Drawings as a single complete package: 2 hard copies and 1 copy on CDROM. Submit hardcopy drawings on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD format.

Draft As-Built Drawings; G, RO

Draft As-Built Drawings as a single complete package: 2 hard copies and 1 copy on CDROM. Submit hardcopy drawings must on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD format.

Final As-Built Drawings; G, RO

Final As-Built Drawings as a single complete package: 2 hard copies and 1 copy on CDROM. Submit hardcopy drawings on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD format.

SD-03 Product Data

Product Data Sheets; G

Computer Software; G, RO

The most recent versions of all computer software provided under this specification delivered as a Technical Data Package. Submit the user manuals for all software delivered for this project with the software.

Enclosure Keys

SD-05 Design Data

EMCS IP Network Bandwidth Usage Estimate; G, RO

Four copies of the EMCS IP Network Bandwidth Usage Estimate.

SD-06 Test Reports

Pre-Construction QC Checklist; G, RO

Four copies of the Pre-Construction QC Checklist.

Post-Construction QC Checklist; G, RO

Four copies of the Post-Construction QC Checklist.

PVT Phase I Procedures; G, RO

Four copies of the PVT Phase I Procedures. The PVT Procedures may be submitted as a Technical Data Package.

PVT Phase I Report; G, RO

Four copies of the PVT Phase I Report. The PVT Phase I Report may be submitted as a Technical Data Package.

PVT Phase II Report; G, RO

Four copies of the PVT Phase II Report. The PVT Phase II Report may be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G, RO

Four bound O&M Instructions and 1 copy of the Instructions in PDF format on optical disc. Index and tab bound instructions. Submit instructions in PDF form as a single PDF file, or as multiple PDF files with a PDF file table of contents containing links to the other files. O&M Instructions may be submitted as a Technical Data Package.

Preventive Maintenance Work Plan; G, RO

Four copies of the Preventive Maintenance Work Plan. The Preventive Maintenance Work Plan may be submitted as a Technical Data Package.

Basic Training Documentation; G, RO

Training manuals for Basic Training delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with the archival copies. The Basic Training Documentation may be submitted as a Technical Data Package.

Advanced Training Documentation; G, RO

One set of training manuals delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with the archival copies. The Advanced Training Documentation may be submitted as a Technical Data Package.

Refresher Training Documentation; G, RO

One set of training manuals delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with the archival copies. The Refresher Training Documentation may be submitted as a Technical Data Package.

SD-11 Closeout Submittals

Closeout QC Checklist; G, RO

Four copies of the Closeout QC Checklist.

1.5 PROJECT SEQUENCING

TABLE I. PROJECT SEQUENCING specifies the sequencing of submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column)

and activities as specified in PART 3 EXECUTION (denoted by an 'E' in the 'TYPE' column).

1.5.1 Sequencing for Submittals

The sequencing specified for submittals is the deadline by which the submittal must be initially submitted to the Government. Following submission there will be a Government review period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within 14 days of notification that the submittal has been rejected. Upon re-submittal there will be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

1.5.2 Sequencing for Activities

The sequencing specified for activities indicates the earliest the activity may begin.

1.5.3 Abbreviations

In TABLE I the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1		Notice to proceed	
3	S	Design Drawings	after #1
4	S	Product Data Sheets	after #1
5	S	EMCS IP Network Bandwidth Usage Estimate	after #1
6	S	Pre-construction QC Checklist	after #1
7	E	Install EMCS	AAO #2 thru #6
8	E	Start-Up and Start-Up Testing	ACO #7
9	S	Post-Construction QC Checklist	ACO #8

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
10	S	Computer Software	ACO #8
11	S	Start-Up and Start-Up Testing Report	ACO #8
12	S	Draft As-Built Drawings	ACO #8
13	S	PVT Phase I Procedures	before scheduled start of #14 and AAO #11
14	E	PVT Phase I	AAO #13 and #12
15	S	PVT Phase I Report	ACO #14
16	S	Preventive Maintenance Work Plan	AAO #11
17	S	O&M Instructions	AAO #11
18	S	Basic Training Documentation	AAO #11 and before scheduled start of #19
19	E	Basic Training (PVT Phase II)	AAO #16, #17 and #18
20	S	PVT Phase II Report	ACO #19
21	S	Final As-Built Drawings	AAO #20
22	S	Advanced Training Documentation	before schedule start of #23 and AAO #18
23	E	Advanced Training	ACO #19, AAO #22, and no later than 60 days ACO #19
24	S	Refresher Training Documentation	before #25 and AAO #18 and #22
25	E	Refresher Training	ACO #19 and AAO #24
26	S	Closeout QC Checklist	ACO #23

1.6 QUALITY CONTROL (QC) CHECKLISTS

The Contractor's Chief Quality Control (QC) Representative must complete the QC Checklist in APPENDIX A, and must submit the Pre-Construction QC

Checklist, Post-Construction QC Checklist and Closeout QC Checklist as specified. The QC Representative must verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative must sign and date the Checklist prior to submission to the Government.

The APPENDIX A QC Checklist is available as an editable file at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-25-10-10.

1.7 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Provide EMCS Operation and Maintenance Instructions which include:

a. Procedures for the EMCS system start-up, operation and shut-down.

b. Final As-Built drawings.

c. Routine maintenance checklist, arranged in a columnar format: The first column listing all installed devices, the second column stating the maintenance activity or stating that no maintenance required, the third column stating the frequency of the maintenance activity, and the fourth column providing any additional comments or reference.

d. Qualified service organization list including points of contact with phone numbers.

e. Start-Up and Start-Up Testing Report.

f. Performance Verification Test (PVT) Procedures and Reports.

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

2.1.1 Product Certifications

For computing devices, as defined in FCC Part 15, supplied as part of the EMCS provide devices which are certified to comply with the requirements of Class B computing devices.

2.1.2 Product Sourcing

For units of the same type of equipment, provide products of a single manufacturer. For each major component of equipment provide equipment with the manufacturer's name and the model and serial number in a conspicuous place. For materials and equipment, provide new standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products.

2.1.3 General Requirements

Provide components that meet the following requirements:

a. Portions of the data communications equipment system installed in unconditioned spaces must operate properly in an environment with ambient temperatures between 32 and 120 degrees F and ambient relative humidity between 10 percent and 90 percent noncondensing.

b. Components must accept 100 to 125 volts AC (Vac), 60 Hz, single phase, three wire with a three-pronged, dedicated circuit outlet or be provided with a transformer to meet the component's power requirements.

c. The equipment must meet the requirements of NFPA 70, UL 60950, NFPA 262, FCC EMC, and FCC Part 15.

2.1.4 Nameplates

Provide nameplates of laminated plastic identifying the function, network address, if applicable, and identifier of the device. Laminated plastic must be at least 0.125 inch thick, white with black center core. Nameplates must be a minimum of 1 by 3 inch with minimum 0.25 inch high engraved block lettering.

2.1.5 Product Data Sheets

For all products (equipment) specified in PART 2 and supplied under this contract, submit copies of all manufacturer catalog cuts and specification sheets to indicate conformance to product requirements. For Monitoring and Control (M&C) Software also include the PICS verifying BTL Listing as a B-AWS.

2.2 CONTROL HARDWARE

2.2.1 Control Protocol Routers

2.2.1.1 BACnet/IP Router

Provide BACnet/IP Routers which perform layer 3 routing of ASHRAE 135 packets over an IP network in accordance with ASHRAE 135 Annex J and Clause 6. The router must provide the appropriate connection to the IP network and connections to a ASHRAE 135 MS/TP network. Devices used as BACnet/IP Routers must be BTL Listed and must support the Network Management-Router Configuration-B (NM-RC-B) BIBB.

2.2.2 Monitoring and Control (M&C) Controller Hardware

Provide Monitoring and Control (M&C) Controller Hardware which is a microprocessor-based direct digital control hardware and which communicates over the EMCS IP network using one of:

a. ASHRAE 135 in accordance with ASHRAE 135 Annex J and using only Standard ASHRAE 135 services.

Monitoring and Control (M&C) Controller Hardware must either meet the requirements of the LonMark Interoperability Guide or be BTL Listed.

2.2.3 BACnet Supervisory Controller Hardware

Provide BACnet Supervisory Controller Hardware which is direct digital control hardware and which:

a. Is BTL Listed.

b. Communicates using ASHRAE 135 over an IP network in accordance with ASHRAE 135 Annex J.

c. has a configurable Object_Name Property.

d. Supports the following BIBBS:

(1) DS-RP-B (Data Sharing–Read Property–B) BIBB for Objects requiring read access from the M&C Software.

(2) DS-WP-B (Data Sharing–Write Property–B) BIBB for Objects requiring write access from the M&C Software.

(3) SCHED-E-B (Scheduling-External-B).

(4) AE-N-I-B (Alarm and Event-Notification Internal-B).

(5) AE-ACK-B (Alarm and Event-ACK-B).

(6) T-VMT-I-B (Trending-Viewing and Modifying Trends-Internal-B).

(7) T-ATR-B (Trending-Automated Trend Retrieval-B).

e. Has a Writable Recipient_List Property of the Notification Class Object.

2.2.4 Control Protocol Gateways

Provide Control Protocol Gateways which perform bi-directional protocol translation between two of the following protocols, or between one of the following protocols and another protocol: CEA-709.1-D, ASHRAE 135, MODBUS Protocol, MODBUS TCP/IP, and OPC DA. Provide Control Protocol Gateways which also meet the following requirements.

a. Gateways must have two or more separate network connections, each appropriate for the protocol and media used. A single network connection must not be used for both protocols.

b. Gateways must be capable of being installed, configured and programmed through the use of instructions in the manual supplied by the Contractor.

c. Provide and license to the Government all software required for gateway configuration.

d. Gateways must retain their configuration after a power loss of an indefinite time, and must automatically return to their pre-power loss state once power is restored.

e. Gateways must provide capacity for mapping all required points as indicated plus an additional 10 percent between the two protocols it uses.

f. Gateways must, in addition, meet all requirements specified (in the following subparagraphs) for each of the two protocols it translates.

2.2.4.1 Gateway for CEA-709.1

For a gateways using CEA-709.1-D provide gateways which meet the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Network Variable Types (SNVTs) according to the

LonMark SNVT List.

b. Gateways communicating CEA-709.1-D over an IP network must communicate in accordance with CEA-852-C.

c. It must allow of its standard network variables (SNVTs) and support transmitting data using the "min, max, and delta" (throttling and heartbeat) methodology.

d. It must provide the ability to label SNVTs.

e. It must supply a LonMark external interface file (XIF) as defined in the LonMark XIF Guide for use with LNS tools and utilities.

f. It must have a "service pin" which, when pressed, will cause the Gateway to broadcast its 48-bit NodeID and ProgramID over the network.

g. It must provide a configurable self-documenting string.

2.2.4.2 Gateway for ASHRAE 135

For gateways using ASHRAE 135 provide gateways which meets the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Objects as defined in ASHRAE 135.

b. All ASHRAE 135 Objects must have a configurable Object_Name Property.

c. It must be BTL Listed.

d. Gateways communicating ASHRAE 135 over an IP network must communicate in accordance with ASHRAE 135 Annex J.

e. Gateways communicating ASHRAE 135 to a field control systems must support the DS-RP-A (Data Sharing–Read Property–A) BIBB and the DS-WP-A (Data Sharing–Write Property–A) BIBB.

f. Gateways communicating ASHRAE 135 to the M&C Software or to a BACnet Supervisory Controller must support the DS-RP-B (Data Sharing–Read Property–B) BIBB for Objects requiring read access from the M&C Software and the DS-WP-B (Data Sharing–Write Property–B) BIBB for Objects requiring write access from the M&C Software.

2.2.4.3 Gateway for Modbus

For gateways that use MODBUS Protocol/MODBUS TCP/IP provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway to MODBUS Protocol/ MODBUS TCP/IP registers using the four standard Modbus register types (Discrete Input, Coil, Input Register,and Holding Register). Gateways communicating MODBUS Protocol/MODBUS TCP/IP to the M&C Software must communicate via MODBUS Protocol/MODBUS TCP/IP over TCP/IP.

2.2.4.4 Gateway for OPC

For gateways that use OPC DA, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway using OPC DA tags and which communicate over an IP network

in accordance with OPC DA.

2.2.4.5 Gateway for DNP3

For gateways that use DNP3, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway to DNP3 object groups and variations as defined by IEEE 1815. Gateways communicating DNP3 over an IP network must communicate in accordance with the LAN/WAN Networking volume of IEEE 1815.

2.3 COMPUTER SOFTWARE

2.3.1 BACnet Network Browser

Provide a BACnet Network Browser software that:

a. Can perform full discovery of a ASHRAE 135 system including but not limited to discovery of all ASHRAE 135 devices, the ASHRAE 135 Objects and Properties of each device, and the standard ASHRAE 135 services supported by each device.

b. Can read any ASHRAE 135 Property of any Object in any device. Proprietary Properties may be presented as read without further interpretation.

c. Can write any Standard ASHRAE 135 Property of any Object in any device.

d. Supports segmentation.

e. Supports all of the following BIBBs:

(1) DM-ANM-A (Device Management-Automatic Network Management-A).

(2) DM-ADM-A (Device Management-Automatic Device Management-A).

(3) DM-DDB-A (Device Management-Dynamic Device Binding-A).

(4) DM-DOB-A (Device Management-Dynamic Object Binding-A).

(5) DS-RP-A (Data Sharing-Read Property-A).

(6) DS-RPM-A (Data Sharing-Read Property Multiple-A).

(7) DS-WP-A (Data Sharing-Write Property-A).

2.3.2 Monitoring and Control (M&C) Software

Provide monitoring and control (M&C) software which is a client-server software package with a graphical user interface (GUI) using web-browser based clients. Provide M&C Software which communicates via ASHRAE 135, and the M&C Software may support other field control protocols. Provide M&C Software which is BACnet Testing Laboratories Certified ("Listed") as a B-AWS.

Provide a single software package which implements the Scheduling, Alarming, Trending, Graphical System Display, and System Display Editor functionality. Other specified M&C functionality may be implemented in the same software package or in additional software packages. As specified in PART 3 EXECUTION, the M&C Software must operate on Server

hardware, except that software for Point Calculations and Demand Limiting may operate on M&C Controller Hardware.

2.3.2.1 M&C Software License

License the M&C Software as specified. Use of multiple copies of M&C Server software working in coordination and sharing data between them such that they function as, and appear to an operator as, a single M&C Server is permitted to meet these requirements.

2.3.2.1.1 Network Points

Provide M&C Software and licensing to support no less than 50,000 network points, and to be capable of expansion.

2.3.2.1.2 Web Clients

Provide M&C Software and licensing to support no less than 10 simultaneous web clients with no limit on the total number of web clients. M&C Software must be capable of expansion to support no less than 30 simultaneous web clients.

2.3.2.1.3 Calculations

Provide M&C Software and licensing to support no less than one calculated point for every ten network points (see "Network Points" above).

2.3.2.1.4 Other Points

For installations using M&C Software installed on M&C Controller Hardware (as opposed to Server hardware), provide additional licensing to support additional network points for the communications between portions of the M&C Software installed on different hardware. For example, if the Calculations requirement is performed by M&C Software installed on Controller hardware, the M&C Software must be licensed for additional network points to cover the network points required for communication between the Controller hardware and the Server hardware.

2.3.2.1.5 Alarming

Provide M&C Software and licensing to support the handling (routing) of alarms for no less than 10,000 ASHRAE 135 Alarm Event Notifications.

2.3.2.1.6 Trending

Provide M&C Software and licensing to support a minimum of 8,000 simultaneous trends.

2.3.2.2 M&C Software Update Licensing

In addition to all other licensing requirements, provide M&C Software licensing which includes licensing of the following software updates for a period of no less than 5 years:

a. Security and bug-fix patches issued by the M&C Software manufacturer.

b. Security patches to address any vulnerability identified in the National Vulnerability Database at http://nvd.nist.gov with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or

higher.

2.3.2.3 Supported Field Control Protocols

Provide M&C Software which supports field control protocols as follows:

a. The M&C Software must include a driver to ASHRAE 135 over IP in accordance with ASHRAE 135 Annex J.

b. The M&C Software may, in addition, include drivers to other protocols.

Provide M&C Software capable of reading values from and writing values to points via any supported field protocol, and capable of reading values from one field protocol and writing them to another. All points obtained from any field protocol must be available to all M&C Software functionality.

2.3.2.4 Supported Enterprise Protocols

Provide M&C Software which supports oBIX, BACnet Web Services or OPC as an enterprise protocol and which meets the following requirements:

a. It is able to read values from any point or collection of points (network point, internal point, trend log or schedule) and transmit these values via the enterprise protocol.

b. It is able to receive data via the enterprise protocol and use this data to change the value of any point.

c. License the enterprise protocol interface to the project site and document he interface such that any system capable of communicating with that protocol can be used to read and write data from the M&C Software.

2.3.2.5 Point Information

Every point, both network and internal, in the M&C Software must contain the following fields:

2.3.2.5.1 Name

A configurable name used for identification of the point within the M&C Software.

2.3.2.5.2 Description

A configurable description of no less than 80 alpha-numeric characters.

2.3.2.5.3 Value

A field containing the current point value.

2.3.2.5.4 Units

A field containing the engineering units.

2.3.2.5.5 Source

A field identifying the source of the point. For network points, this is

generally the address or identification of the field device (for example, the Domain-Subnet-Node address for LonWorks field control devices or the DeviceID for BACnet devices).

2.3.2.6 Point Calculations

Provide M&C software capable of performing calculations and computing the value of a calculated point based on the values of two or more network points and calculated points. Mathematical operators must include: Addition, subtraction, multiplication, division, exponentiation (y^x, power), square root, reciprocal, natural logarithm, sin, cos, tan, arcsin, arccos, arctan, and parenthesis. Pi and e must be available as constants for use in calculations.

2.3.2.7 Browser-Based Graphical User Interface (GUI)

Provide M&C Software which includes a web-browser based (client-server) graphical user interface through which all M&C Software functionality, except for the Graphics Editor, System Display Editor, report configuration, point calculation configuration, and enterprise protocol configuration, is accessible.

Provide graphical user interface web server and web clients meeting the following requirements:

a. The web server must use HTTPS based on the Transport Layer Security (TLS) Protocol in accordance with IETF RFC 7465 using a Government-furnished certificate.

b. The graphical user interface must be Common Access Card (CAC) enabled: It must support web client authentication using certificates obtained from a Department of Defense Common Access Card (CAC) Smart Card.

c. The web client must operate on any version of Windows currently supported by Microsoft.

d. The web client must function in the most recent three version of Internet Explorer and the most recent three versions of Microsoft Edge.

e. The web client must not require a connection to any server other than the M&C Server.

f. The web client must function in a browser with Java, Shockwave, Silverlight, and Flash installed. The client may require a download of mobile code from the M&C Server, but must not require the download of additional browser plug-ins or add-ins and there must be no limit on the number of downloads. The client must not require ActiveX.

2.3.2.8 Passwords

Provide M&C software with user-based access control to M&C functionality. The M&C Software must recognize at least 100 separate users and have at least 4 levels of user permissions. User permission levels (from most restrictive to most permissive) must include:

a. Permission Level 1: View-only access to the graphical user interface.

b. Permission Level 2: Permission Level 1 plus acknowledge alarms and

set up (configure) trends and reports.

c. Permission Level 3: Permission Level 2 plus override points and set up (configure) alarms, schedules and demand limiting.

d. Permission Level 4: Permission Level 3 plus create and modify Graphical System Displays using the System Display Editor.

Passwords must not be displayed and must not be logged. The system must maintain a disk file on the server hardware logging all activity of the system. This file must maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. If the file format is not plain ASCII text, provide a means to export or convert the file to plain ASCII text. Provide a mechanism for archiving the log files for long term record storage.

2.3.2.9 Graphical System Displays

Provide graphical displays consisting of building system (air handler units, VAV boxes, chillers, cooling towers, boilers, etc.) graphic displays. Data associated with an active display must be updated at least once every 5 seconds.

2.3.2.9.1 Navigation Scheme

System graphic displays of building systems and points must be hierarchical displays using a building-to-equipment point-and-click navigation scheme which allows navigation from a garrison-wide display, through a building-wide display to the individual units. Each display must show the building name and number. Each display must show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

a. For each Building or Building Sub-Area display, show the building foot print and basic floor plan, and clearly show and distinguish between the individual zones and the equipment serving each zone and space. Show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. Show the locations of individual pieces of monitored and controlled equipment.

b. For each equipment display show a one-line diagram control schematic or 3-dimensional representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Use different colors and textures to indicate various components and real time data. Use consistent color and texture meanings across all displays.

c. Provide displays which clearly distinguish between the following point data types and information:

(1) Real-time data.

(2) Other user-entered data.

(3) Devices in alarm (unacknowledged).

(4) Out-of-range, bad, or missing data.

(5) Points which are overridden.

2.3.2.9.2 Navigation Commands

Provide system displays which support English language operator commands via point-and-click mouse or keyboard entry for defining and selecting points, parameters, graphics, report generation, and all other functions associated with operation. The operator commands must be usable from any operator workstation with individual operator passwords as specified.

2.3.2.10 Graphic Editor

Provide a fully featured graphics editor and capable of creating custom graphics and graphic symbols for use by the System Display Editor.

2.3.2.11 System Display Editor

Provide a system display editor which allows the user to create, modify, and delete graphic displays. The display editor may have a separate user interface and is not required to be accessible via the web browser interface. Provide a display editor which includes the following functions:

a. Create and save displays. Save an existing or modified display as a new display (i.e., "save as").

b. Group and ungroup graphics, where graphics include both alphanumeric and graphic symbols, and where a grouped graphic is manipulated as a single graphic.

c. Place, locate, resize, move, remove, reposition, rotate and mirror a graphic on a display.

d. Overlay graphics over other graphics and assign depths such that when there are coincident graphics the one on top is visible.

e. Modify graphic properties based on the value of network points and create conditions governing the display of a graphics such that different graphics are visible based on the value of network points or calculated points.

f. Integrate real-time data with the display.

g. Establish connecting lines.

h. Establish sources of latest data and location of readouts.

i. Display analog values as specified.

j. Assign conditions which automatically initiate a system display.

k. Include library of display symbols which include: Pump, Motor, Two- and Three-way Valves, Flow Sensing Element, Point and Averaging Temperature Sensors, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Chilled Water Piping, Steam Piping, Hot Water Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, High- and Low- Point and Averaging Temperature Switches,

High- and Low- Pressure Switches, Coil, Solenoid Valve, Filter, Condensing Unit, Variable Frequency Drive (VFD), Heat Exchanger, Current Sensing Relays, Generator, Circuit Breaker, Transformer, Tank. Symbols must at a minimum conform to ASHRAE FUN IP where applicable.

2.3.2.12 Scheduling

a. The M&C software must be capable of performing time synchronization and configuring Schedule Objects in ASHRAE 135 field devices in accordance with the DM-MTS-A (Device Management-Manual Time Synchronization-A).

b. The M&C Software must include a scheduling graphic display, accessible via the graphical user interface, with the following fields and functions:

(1) Current date and time.

(2) System identifier(s) and name(s), including location information such as Building name(s) and number(s).

(3) System group. Systems grouped by the user to perform according to a common schedule.

(4) Weekly schedules. For each system, a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than 6 value changes per day.

(5) Holiday and special event schedules. Support for holiday and special event calendar schedules independent of the daily schedule. Special event schedules include one-time events and recurring events. Scheduling of one-time events include the beginning and ending dates and times of the event. Holiday and special event schedules must have precedence over device weekly schedules.

2.3.2.13 Alarms

Provide M&C Software meeting the following minimum requirements for alarms:

a. The M&C software must be capable of configuring alarms in ASHRAE 135 field devices in accordance with the B-AWS BIBBs.

b. The M&C software must be capable of handling (routing) alarms received as an ASHRAE 135 Alarm Event Notifications.

c. The M&C software must support at least two alarm priority levels: Critical and informational. Critical alarms must remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms must remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.

d. The creation, modification, and handling (routing) of alarms must be fully accessible and fully adjustable from the graphical user interface.

e. Alarm Data. Alarm data to be displayed and stored must include:

(1) Identification of alarm including building, system (or sub-system), and device name.

(2) Date and time to the nearest second of occurrence.

(3) Alarm type:

(a) Unreliable: Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.

(b) High Alarm.

(c) Low Alarm.

(4) Current value or status of the alarm point, including engineering units.

(5) Alarm limits, including engineering units.

(6) Alarm priority.

(7) Alarm Message: A unique message with a field of at least 60 characters. Assignment of messages to an alarm must be an operator editable function.

(8) Acknowledgement status of the alarm including the time, date and user of acknowledgement.

f. Alarm Notification and Routing: The M&C software must be capable of performing alarm notification and routing functions. Upon receipt of ASHRAE 135 event notification, the M&C software must immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software must support at least 100 alarm routes, where an alarm route is a unique combination of any of the following activities:

(1) Generate a pop-up up active clients. The pop-up display must include the Alarm Data. Alarms must be capable of being acknowledged from the pop-up display by operators with sufficient permissions. Pop-up must be displayed until acknowledged.

(2) Send an e-mail message via simple mail transfer protocol (SMTP; RFC 821). The e-mail must contain a configurable message and all alarm data. The e-mail recipient and scripted message must be user configurable for each alarm route.

(3) Print alarms to designated alarm printers. The printed message must be the same as the pop-up message.

g. Alarm Display and Acknowledgement. The M&C software must include an alarm display. Alarms must be available for display at each workstation as shown, along with all associated alarm data. Alarms must be capable of being acknowledged from this display. Multiple alarms must be capable of being acknowledged using a single command. Operator acknowledgment of one alarm must not automatically be considered as acknowledgment of any other alarm nor may it inhibit reporting of subsequent alarms.

h. Alarm Storage and Reports: The M&C software must store each alarm and its associated alarm data to hard disk and retain this information after the alarm no longer exists. The stored data must be sortable, searchable, and printable.

2.3.2.14 Trending

Provide M&C software capable of creating, modifying, uploading and archiving ASHRAE 135 Trend Objects in field devices in accordance with the B-AWS BIBBs.

a. The M&C Software must include a graphical display for trend configuration, creation and deletion accessible through the graphical user interface. Each trend must be user-configurable for:

(1) Point to trend.

(2) Sampling interval: Adjustable between 1 second and 1 hour.

(3) Start and Stop Time of Trend: Start and stop times determined by one or more of the following methods:

(a) Start time and stop time.

(b) Start time and duration.

(c) Start time and number of samples.

b. The M&C software must be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software must be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, provide a means to export or convert the file to plain ASCII text in a CSV format.

2.3.2.15 Report Generation

Provide M&C Software capable of generating, saving and printing reports. Dynamic operation of the system must not be interrupted to generate a report. The report must contain the time and date when the samples were taken, and the time and date when the report was generated. The software must be capable of saving reports to a PDF file and to a file compatible with the provided Office Automation Software.

The software must allow for automatic and manual generation of reports. For automatic reports an operator must be able to specify the time the initial report is to be generated, the time interval between reports, end of period, and the output format for the report. Manual report generation must allow for the operator to request at any time the output of any report.

2.3.2.16 Custom Report Generation

Provide M&C software capable of generating custom reports, including but not limited to the following standard reports:

2.3.2.16.1 Electrical Power Usage Report

An electrical power Usage summary, operator selectable for substations,

meters, or transducers, individual meters and transducers, any group of meters and transducers, and all meters for an operator selected time period. The report must include the voltage, current, power factor, electrical demand, electrical power consumption, reactive power (Kvar) for each substation, facility, system or equipment as selected by the operator. The report must be automatically printed at the end of each summary period and include:

a. Total period consumption.

b. Demand interval peak for the period, with time of occurrence.

c. Energy consumption (kWh) over each demand interval.

d. Time-of-use peak, semi-peak, off-peak, or baseline total kWh consumption.

e. Reactive power during each demand interval.

f. Power factor during each demand interval.

g. Outside air (OA) temperature and relative humidity (RH) taken at the maximum and minimum of OA temperature of the report period with the time and dates of occurrence. At the installation's peak demand interval, the OA temperature and RH must also be recorded.

h. Calculated heating and cooling degree days based on a 65 degrees F balance point.

2.3.2.16.2 Electrical Peak Demand Prediction Report

A report based on the demand limiting program, which includes:

a. Electrical Demand Target (EDT).

b. Actual peak and predicted peak for each demand interval for that day.

c. Predicted demand for the next demand interval.

2.3.2.16.3 Energy Usage Report

An energy usage summary, operator selectable, for a unit, building, area, installation, and the entire EMCS. The report must be divided by utility, and must be capable of reporting on at least four separate utilities. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy usage for each utility for the current and previous day.

c. Total energy usage for each utility for the current and previous month.

d. Maximum 15-minute interval average rate of consumption for each utility for the current and previous day and current and previous month.

e. Outside air (OA) temperature and OA humidity for current and previous month and current and previous day:

(1) Average temperature and humidity.

(2) Temperature and humidity at maximum and minimum OA temperature with time and date of occurrence.

(3) Temperature and humidity at maximum and minimum humidity with time and date of occurrence.

(4) Temperature and humidity at the installation's peak demand interval with the time and date of occurrence.

f. Calculated degree days. Reports which include humidity must be configurable to report either dewpoint or relative humidity.

2.3.2.16.4 Water Usage Report

A water usage summary, operator selectable, for a unit, building, area, installation, and the entire EMCS. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy water usage for the current and previous day.

c. Total water usage for the current and previous month.

2.3.2.16.5 Alarm Report

Outstanding alarms by building or unit, including time of occurrence.

2.3.2.16.6 M&C Software Override Report

Points overridden by the M&C Software, including time overridden, and identification of operator overriding the point.

2.3.2.16.7 Run Time Reports

A report totalizing the accumulated run time of individual pieces of equipment. The operator must be able to define equipment groupings and to generate reports based on these groupings.

2.3.2.16.8 Chiller usage Report

A report of the operation of each chiller as shown on a daily and monthly basis, for each of at least 10 discrete loading levels. The report must include:

a. Average power for the month at each level in kW.

b. Total monthly energy use in kWh at each level.

c. Total monthly energy use in kWh for the chiller (all levels).

d. Total daily run hours at each level.

e. Total Monthly run hours at each level.

2.3.2.16.9 Device Offline Report

A report listing all offline devices in all ASHRAE 135 building control systems integrated to the M&C Software.

2.4 UNINTERRUPTIBLE POWER SUPPLY (UPS)

Provide uninterruptible power supplies (UPS) as self contained devices suitable for installation and operation at the location of Server hardware and sized to provide a minimum of 20 minutes of operation of the connected hardware. Equipment connected to the UPS must not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. Provide the UPS complete with all necessary power supplies, transformers, batteries, and accessories. Provide UPS which include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power. Provide UL 1778 approved UPS. UPS powering Server Hardware must notify the server via USB interface of impending battery failure.

2.5 RACKS AND ENCLOSURES

2.5.1 Enclosures

Enclosures supplied as an integral (pre-packaged) part of another product are acceptable. Provide two Enclosure Keys for each lockable enclosure on a single ring per enclosure with a tag identifying the enclosure the keys operate. Provide enclosures meeting the following minimum requirements:

2.5.1.1 Outdoors

For enclosures located outdoors, provide enclosures meeting NEMA 250 Type 4 requirements.

2.5.1.2 Mechanical and Electrical Rooms

For enclosures located in mechanical or electrical rooms, provide enclosures meeting NEMA 250 Type 2 requirements.

2.5.1.3 Other Locations

For enclosures in other locations including but not limited to occupied spaces, above ceilings, and in plenum returns, provide enclosures meeting NEMA 250 Type 1 requirements.

2.5.2 Equipment Racks

Provide standard 19 inch equipment racks compatible with the electronic equipment provided. Racks must be either aluminum or steel with bolted or welded construction. Steel equipment racks must be painted with a flame-retardant paint. Guard rails must be included with each equipment rack and have a copper grounding bar installed and grounded to the earth.

PART 3 EXECUTION

3.1 DRAWINGS AND CALCULATIONS

3.1.1 EMCS IP Network Bandwidth Usage Estimate

Provide a EMCS IP Network Bandwidth Usage Estimate for a small, medium or large systems. In this estimate account for field control systems using all M&C required protocols and the integration of field control system via gateways. Define all assumptions used to create the estimate, including but not limited to: Trending, fast trends for commissioning, schedules, alarms, display of system graphics and load shedding.

3.1.2 EMCS Contractor Design Drawings

Revise and update the Contract Drawings to include details of the system design and all hardware components, including Contractor provided and Government furnished components. Details to be shown on the Design Drawing include:

a. The logical structure of the network, including but not limited to the location of all Control Hardware (including but not limited to each BACnet Supervisory Controller, Control Protocol Gateway, Control Protocol Router, and Monitoring and Control (M&C) Controller).

b. Manufacturer and model number for each piece of Control Hardware.

c. Physical location for each piece of Control Hardware.

d. Version and service pack number for all software and for all Control Hardware firmware.

3.1.3 As-Built Drawings

Prepare draft as-built drawings consisting of Points Schedule drawings for the entire EMCS, including Points Schedules for each Gateway, and an updated Design Drawing including details of the actual installed system as it is at the conclusion of Start-Up and Start-Up Testing. Provide As-Built Drawings which include details of all hardware components, including Contractor provided and Government furnished components. In addition to the details shown in the design drawings, the as-built drawing must include:

a. IP address(es) and Ethernet MAC address(es) as applicable for each piece of Control Hardware (including but not limited to each BACnet Supervisory Controller, Control Protocol Gateway, Control Protocol Router, and Monitoring and Control (M&C) Controller).

b. IP address and Ethernet MAC address for each computer server, workstation, and networked printer.

c. List of ports, protocols and network services for each device connected to an IP network.

d. Network Addresses: ASHRAE 135 address and Object_ID of the Device Object for all Control Hardware using ASHRAE 135.

Prepare Draft As-Built Drawings upon the completion of Start-Up and Start-Up Testing and Final As-Built Drawings upon completion of PVT Phase

II.

3.2 INSTALLATION REQUIREMENTS

3.2.1 General

Install system components as shown and specified and in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Install communication equipment and cable grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. Install Fiber Optic cables and wiring in exposed areas, including low voltage wiring but not including network cable in telecommunication closets, in metallic raceways or EMT conduit as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Do not install equipment in any space which experiences temperatures or humidity outside of the rated operating range of the equipment.

3.2.2 Isolation, Building Penetrations and Equipment Clearance

Provide dielectric isolation where dissimilar metals are used for connection and support. Make all penetrations through and mounting holes in the building exteriors watertight. Drill or core drill holes in concrete, brick, steel and wood walls with proper equipment. Seal conduits installed through openings with materials which are compatible with existing materials. Seal openings with materials which meet the requirements of NFPA 70 and SECTION 07 84 00 FIRESTOPPING.

3.2.3 Nameplates

Provide Nameplates for all Control Hardware and all Computer Hardware. Attach Nameplates to the device in a conspicuous location.

3.3 INSTALLATION OF EQUIPMENT

3.3.1 Wire and Cable Installation

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as indicated. Provide necessary interconnections, services, and adjustments required for a complete and operable signal distribution system. Label components in accordance with TIA-606. Firestop Penetrations in fire-rated construction in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets and raceways in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install wiring in accordance with TIA-568-C.1 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Mark wiring terminal blocks and outlets in accordance with TIA-606. Do not install non-fiber-optic cables in the same cable tray, utility pole compartment, or floor trench compartment with power cables. Properly secure and install neat in appearance cables not installed in conduit or raceways.

3.3.2 Grounding

Install signal distribution system ground in accordance with TIA-607 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Connect equipment racks to the electrical safety ground.

3.3.3 Power-Line Surge Protection

Protect equipment connected to ac circuits must be protected against or withstand power-line surges. Provide equipment protection which meets the requirements of IEEE C62.41. Do not use fuses for surge protection.

3.3.4 IP Addresses

For all Control Hardware requiring an IP address on the EMCS IP Network, coordinate with the representative identified by the Contracting Officer to obtain IP addresses.

3.3.5 Computer Hardware and Software

3.3.5.1 Software Installation

Install software as follows:

a. BACnet Network Browser: Install the BACnet Network Browser software as indicated. Install the BACnet Network Browser on workstation hardware.

b. Monitoring and Control Software: Install the monitoring and control (M&C)software as shown. Except for M&C Software performing Point Calculations or Electrical Peak Demand Limiting, install M&C Software on server hardware. Install M&C Software performing Point Calculations or Electrical Peak Demand Limiting on either server hardware or Monitoring and Control (M&C) Controller Hardware. Install M&C Software in a manner consistent with its B-AWS listing such that it provides all functionality of a B-AWS.

   Provide sufficient computer hardware and M&C Controller Hardware and install M&C Software to support the number of points required in PART 2 (PRODUCTS), regardless of the number of points integrated under this project specification. Note that meeting this requirement may entail the installation of unused hardware or spare point licenses to accommodate the full number of required points in order to allow for integration of future field control systems.

c. M&C Controller Hardware Configuration Software: Install the M&C Controller Hardware Configuration Software on server hardware.

3.3.5.2 Monitoring and Control (M&C) Software Configuration

Configure the Monitoring and Control (M&C) Software as specified, as indicated and as follows:

a. Set up M&C Software user accounts and passwords. Coordinate user accounts, passwords and permissions with the Controls HVAC shop supervisor.

b. Change the default password on all accounts. Remove or disable any accounts which do not require authentication (such as guest accounts).

c. Configure e-mail capability to use a Government furnished SMTP server. Coordinate with the Contracting Officer for SMTP server information.

d. Disable all ports, protocols, and network services other than those

required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet, and SSH.

e. Install web server certificate.

3.3.5.3 Control Hardware Installation

Install Control Hardware in a lockable enclosure and as specified. Configure Control Hardware as specified, as required to meet the functions for which the hardware is used and as follows:

a. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet, SSH, and HTTP. When disabling of ports, protocols and services is not supported by a product, obtain an exception from this requirement prior to using the product and document non-compliance on the Product Data Sheets and As-Built drawings.

b. Change the default passwords in all Control Hardware which have passwords. Coordinate new passwords with the Controls HVAC shop supervisor.

3.4 INTEGRATION OF FIELD CONTROL SYSTEMS

Fully integrate the field control systems in accordance with the following three step sequence and as specified and shown.

STEP 1: Install and configure Control Hardware as necessary to connect the field control system to the FPOC, which is part of the EMCS IP network, and to provide control protocol translation and supervisory functionality.

STEP 2: Add Field Control System to M&C Software: Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to the field control system.

STEP 3: Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.4.1 Integration Step 1: Install Control Hardware

Install Control Hardware as specified at the FPOC location as shown to connect the field control system to the EMCS IP network via the FPOC and, if necessary, to provide control protocol translation and supervisory functionality. Coordinate all connections and other activities related to an FPOC with the Contracting Officer. Depending on the field control system media and protocol this must be accomplished through one of the following:

a. Connect the existing field control network hardware at the FPOC location to the FPOC.

b. Install a Control Protocol Gateway connected to both the field control network and the FPOC.

c. Install a Control Protocol Router connected to both the field control

network and the FPOC.

d. Install a Control Protocol Gateway connected to the field control network. Then install a Control Protocol Router connected to both the Control Protocol Gateway and the FPOC.

In addition, for integration of field control systems via ASHRAE 135, also install a BACnet Supervisory Controller as needed to implement scheduling, alarming and trending in the field control system. The BACnet supervisory controller may be the same device as the control protocol gateway or router.

3.4.1.1 Installation of Control Protocol Gateway

If the field control system uses a protocol which is not supported by the M&C Software, install a gateway to convert the field control system protocol to ASHRAE 135. Install additional field control system network media and hardware as needed to connect the Gateway to the field control system. Connect the Gateway according to one of the two following methods:

a. Connect the Gateway to the field control network and to the FPOC.

b. Connect the Gateway to the field control network and to a BACnet/IP Router installed as specified.

Create and configure points and establish network communication between the Control Protocol Gateway and the field control system to provide points from the field control system to the M&C software.

3.4.1.2 Installation of Control Protocol Router

If there is not an existing connection between the FPOC and the field control network, install a BACnet/IP Router to connect the field control network to the FPOC. Install additional field control system network media as needed to connect the Router to the field control system.

3.4.1.3 Installation of BACnet Supervisory Controller

If required for implementation of scheduling, alarming and trending, install a BACnet Supervisory Controller connected to the building control system IP network and configure it to provide scheduling, alarming and trending functions for the field control system. When the BACnet Supervisory Controller is the same device as a control protocol router or gateway, install it in accordance with the installation requirements for a router or gateway.

3.4.2 Integration Step 2: Add Field Control System to M&C Software

Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to points and data in the field control system.

3.4.2.1 Integration of Field Control Systems Via ASHRAE 135

Use the M&C Software to fully discover the field control system. Full discovery of a field control system includes but is not limited to discovery of all ASHRAE 135 devices, all standard ASHRAE 135 Objects and Properties of each device, and all standard ASHRAE 135 services supported by each device.

3.4.2.2 Integration of Field Control Systems Via Other (non-ASHRAE 135) Protocols

Perform all actions necessary to make all points as shown on the Points Schedule from the field control system available in the M&C Software.

3.4.3 Integration Step 3: Configure M&C Software

Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.4.3.1 Configure M&C Software Communication

Create and configure points and establish network communication between M&C Software and Field Control Systems as specified to support M&C Software functionality:

a. Update points on currently active displays via polling as necessary to meet M&C Software display refresh requirements.

b. Send points used for overrides to the device receiving the override as shown on the Points Schedule. For BACnet systems write operator overrides with a priority of 8 and demand limiting overrides with a priority of 10.

c. For Notification Class Objects used for Alarms, configure the Recipient_List Property to point to the appropriate M&C Software process. Use the ConfirmedEventNotification service for events from ASHRAE 135 field control systems used for alarms.

Edit the Description field of each point to include the Real Property Unique IDs (RPUID) associated with that point as shown on the Points Schedule.

3.4.3.2 Configure M&C Software Functionality

Fully configure M&C Software functionality using the M&C Software capabilities specified in PART 2 of this Section.

a. Create System Displays including overrides, as shown on the Points Schedule and as specified. Label all points on displays with the point name as shown on the Points Schedule. Configure user permissions for access to and executions of action using graphic pages. Coordinate user permissions with the Controls HVAC shop supervisor.

b. Configure alarm handling as shown on the Points Schedule, as shown on the Alarm Routing Schedule, and as specified. Create and configure Objects in BACnet Supervisory Controllers and in the field control system to support alarming as shown on the Points Schedule and as specified. Alarm events with priority 112 are critical and events with priority 224 are non-critical. For alarm events with other priorities, treat events with priorities of 200 or above as non-critical, and all others as critical. For alarms requiring notification via text message or e-mail, configure the alarm notification to use the specified Government furnished SMTP server to send the alarm notification.

c. Configure scheduling as indicated and as shown on the points schedule. Create and configure Schedule Objects in BACnet Supervisory Controllers or in the field control system.

   Create and configure displays for configuration of Schedule Objects in the field control system. Label schedules and scheduled points with full English-language descriptors. Provide a separate configuration capability for each schedule. A single configuration display may be used to configured multiple schedules, provided that each schedule is separately configurable from the display.

d. Create and configure Trend Objects in BACnet Supervisory Controllers and in the field control system as shown on the Points Schedule and as specified. Trend points at 15 minute intervals.

   Create and configure displays for creation and configuration of trends and for display of all trended points.

e. Configure Demand Limiting as shown on the Demand Limit Schedule and Points Schedule and as specified.

f. Configure M&C Software standard reports.

3.5 START-UP AND START-UP TESTING

Test all equipment and perform all other tests necessary to ensure the system is installed and functioning as specified. Prepare a Start-Up and Start-Up Testing Report documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

3.6 PERFORMANCE VERIFICATION TEST (PVT)

3.6.1 PVT Phase I Procedures

Provide PVT Procedures which include:

a. Network bandwidth usage and available bandwidth (throughput) measurements. Network bandwidth usage must reference the normal usage network Bandwidth Calculations.

b. Test System Reaction during PVT: The total system response time from initiation of a control action command from the workstation, to display of the resulting status change on the workstation must not exceed 20 seconds under system normal heavy load conditions assuming a zero response time for operation of the node's control device.

c. Verification of IP Connectivity.

d. Verification of configuration of M&C Software functionality.

3.6.2 PVT Phase I

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures previously approved by the Government, demonstrate all physical and functional requirements of the project. Upon completion of PVT Phase I and as specified, prepare and submit the PVT Phase I Report documenting all tests performed during the PVT and their

results. In the PVT report, include all tests in the PVT Procedures and any other testing performed during the PVT. Document failures and repairs with test results.

3.6.3 PVT Phase II

Include Basic Training as part of PVT Phase II. Failures or deficiencies of the EMCS during Basic Training are considered PVT failures. Upon completion of PVT Phase II, and as specified, prepare and submit the PVT Phase II Report documenting any failures which occurred and repairs performed during PVT Phase II.

3.7 MAINTENANCE AND SERVICE

Perform inspection, testing, cleaning, and part or component replacement as specified and as required to maintain the warranty. Work includes providing necessary preventive and unscheduled maintenance and repairs to keep the EMCS operating as specified, and accepted by the Government, and other services as specified. Perform work in compliance with manufacturer's recommendations and industry standards. Provide technical support via telephone during regular working hours.

3.7.1 Work Coordination

Schedule and arrange work to cause the least interference with the normal Government business and mission. In those cases where some interference may be essentially unavoidable, coordinate with the Government to minimize the impact of the interference, inconvenience, equipment downtime, interrupted service and personnel discomfort.

3.7.2 Work Control

Upon completion of work on a system or piece of equipment, that system or piece of equipment must be free of missing components or defects which would prevent it from functioning as originally intended and designed. Replacements must conform to the same specifications as the original equipment. During and at completion of work, do not allow debris to spread unnecessarily into adjacent areas nor accumulate in the work area itself.

3.7.3 Working Hours

Working hours are from 6:30 A.M. to 4:00 P.M. local time Mondays through Fridays except Federal holidays.

3.7.4 Replacement, Modernization, Renovation

The Government may replace, renovate, or install new equipment as part of the EMCS at Government expense and by means not associated with this contract without voiding the system warranty. Replaced, improved, updated, modernized, or renovated systems and equipment interfaced to the system may be added to the Contractor's maintenance and service effort as a modification.

3.7.5 Access To EMCS Equipment

Access to EMCS equipment must be in accordance with the following:

a. Coordinate access to facilities and arrange that they be opened and

closed during and after the accomplishment of the work effort. For access to a controlled facility contact the Government for assistance.

b. The Government may provide keys for access to EMCS equipment where the Government determines such key issuance is appropriate. Establish and implement methods of ensuring that keys issued by the Government are not lost or misplaced, are not used by unauthorized persons, and are not duplicated.

c. The Government may provide passwords or issue Common Access Cards (CAC) for access to EMCS computer equipment where the Government determines such issuance is appropriate. Establish and implement methods of ensuring that passwords and Common Access Cards issued by the Government are not used by unauthorized persons.

3.7.6 Records, Logs, and Progress Reports

Keep records and logs of each task, and organize cumulative chronological records for each major component, and for the complete system. Maintain a continuous log for the EMCS. Keep complete logs and be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the EMCS.

3.7.7 Preventive Maintenance Requirements

Prepare a Preventive Maintenance Work Plan as specified.

3.7.7.1 Preventive Maintenance Work Plan

Prepare a Preventive Maintenance Work Plan detailing all required preventive maintenance. Obtain Government approval of the Work Plan as specified in paragraph PROJECT SEQUENCING. Strictly adhere to the approved work plan to facilitate Government verification of work. If it is necessary to reschedule maintenance, make a written request to the Government detailing the reasons for the proposed change at least five days prior to the originally scheduled date. Scheduled dates will be changed only with the prior written approval of the Government.

3.7.7.2 Semiannual Maintenance

Perform the following Semiannual Maintenance as specified:

a. Perform data backups on all Server Hardware.

b. Run system diagnostics and correct diagnosed problems.

c. Perform fan checks and filter changes for EMCS hardware.

d. Perform all necessary adjustments on printers.

e. Resolve all outstanding problems.

f. Install new ribbons, ink cartridges and toner cartridges into printers, and ensure that there is at least one spare ribbon or cartridge located at each printer.

3.7.7.3 Maintenance Procedures

3.7.7.3.1 Maintenance Coordination

Coordinate any scheduled maintenance event that may result in component downtime with the Government as follows, where time periods are measured as actual elapsed time from beginning of equipment off-line period, including working and non-working hours:

a. For non-redundant computer server hardware, provide 14 days notice, components must be off-line for no more than 8 hours.

b. for redundant computer server hardware, provide 7 days notice, components must be off-line for no more than 36 hours.

c. For active (powered) control hardware, provide 14 days notice, components must be off-line for no more than 6 hours.

d. For cabling and other passive network hardware, provide 21 days notice, components must be off-line for no more than 12 hours.

3.7.7.3.2 Software/Firmware

Software/firmware maintenance includes application programs, and files required for the proper operation of the EMCS regardless of storage medium. User (project site) developed software is not covered by this contract, except that the EMCS software/firmware must be maintained to allow user creation, modification, deletion, and proper execution of such user-developed software as specified. Perform diagnostics and corrective reprogramming as required to maintain total EMCS operations as specified. Back up software before performing any computer hardware and software maintenance. Do not modify any parameters without approval from the Government. Properly document any approved changes and additions, and update the appropriate manuals.

3.7.8 Service Call Reception

a. A Government representative will advise the Contractor by phone or in person of all maintenance and service requests, as well as the classification of each based on the definitions specified. A description of the problem or requested work, date and time notified, location, classification, and other appropriate information will be placed on a Service Call Work Authorization Form by the Government.

b. Submit procedures for receiving and responding to service calls 24 hours per day, seven days a week, including weekends and holidays and during regular working hours. Provide a single telephone number for receipt of service calls during regular working hours; service calls are to be considered received at the time and date the telephone call is placed by the authorized Government representative.

c. Separately record each service call request, as received on the Service Call Work Authorization form and complete the Service Call Work Authorization form for each service call. Include the following information in the completed form: The serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started,

and the time and date of completion.

d. Respond to each service call request within two working hours. Provide the status of any item of work within four hours of the inquiry during regular working hours, and within 16 hours after regular working hours or as needed to meet the Equipment Repair requirements as specified.

3.7.9 Service Call Work Warranty

Provide a 1 year unconditional warranty on service call work which includes labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition. In the event that service call work causes damage to additional equipment, restore the system to full operation without cost to the Government. Provide response times for service call warranty work equivalent to the response times required by the initial service call.

3.7.10 System Modifications

Make recommendations for system modification in writing to the Government. Do not make system modifications without prior approval of the Government. Incorporate any modifications made to the system into the Operations and Maintenance Instructions, and any other documentation affected. Make available to the Government software updates for all software furnished under this specification during the life of this contract. Schedule at least one update near the end of the contract period, at which time make available the latest released version of all software provided under this specification, and install and validate it upon approval by the Government.

3.8 TRAINING

Conduct training courses for designated personnel in the maintenance, service, and operation of the system as specified, including specified hardware and software. The training must be oriented to the specific system provided under this contract. Provide audiovisual equipment and other training material and supplies required for the training. When training is conducted at Government facilities, the Government reserves the right to record the training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor should assume that attendees will be tradesmen such as electricians or boiler operators. Obtain approval of the training schedule from the Government at least 30 days prior to the first day of training.

3.8.1 Training Documentation

Prepare and submit one set of Training manuals for each of Basic Training Documentation, Advanced Training Documentation, and Refresher Training Documentation, where each set of documentation consists of:

3.8.1.1 Course Attendance List

Course Attendance List developed in coordination with and signed by the Controls HVAC shop supervisor.

3.8.1.2 Training Manuals

Include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson in the training manuals. Where portions of the course material are presented by audiovisuals, include copies of those audiovisuals as a part of the printed training manuals.

3.8.2 Basic Training

Conduct a Basic Training course at the project site on the installed system for a period of no less than 5 training days during Phase 2 of the PVT. A maximum of ten personnel will attend this course. Design training targeted towards training personnel in the day-to-day operation and basic maintenance of the system. Upon completion of this course, each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware architecture and operation of the system. Include the following topics at a minimum:

a. General system architecture.

b. Functional operation of the system, including workstations and system navigation.

c. System start-up procedures.

d. Failure recovery procedures.

e. Schedule configuration.

f. Trend configuration.

g. Perform point overrides and override release.

h. Reports generation.

i. Alarm reporting and acknowledgements.

j. Diagnostics.

k. Historical files.

l. Maintenance procedures:

(1) Physical layout of each piece of hardware.

(2) Troubleshooting and diagnostic procedures.

(3) Preventive maintenance procedures and schedules.

3.8.3 Advanced Training

Conduct an Advanced Operator Training course at the project site for a period of not less then five days. A maximum of ten personnel will attend this course. Structure the course to consist of "hands-on" training under the constant monitoring of the instructor. Include training on the M&C Software, and the BACnet Network Browser. Upon completion of this course, the students should be fully proficient in the operation and management of

all system operations and must be able to perform all tasks required to integrate a field control system into the EMCS. Report the skill level of each student at the end of this course. Include the following topics at a minimum:

a. A review of all topics in Basic Training.

b. Using the BACnet Network Browser for network discovery.

c. M&C Software configuration, including but not limited to: Creating and editing system displays, alarms, schedules, trends, demand limiting and calculations.

3.8.4 Refresher Training

Conduct a Refresher Training course at the project site for a period of two training days when approved by the Government and as specified in paragraph PROJECT SEQUENCING. A maximum of ten personnel will attend the course. Structure the course to address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed EMCS. Correct any system failures discovered during the Refresher Training at no cost to the Government.

APPENDIX A

QC CHECKLIST		
This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.		
This checklist is for (check one:)		
	Pre-Construction QC Checklist Submittal (Items 1-2)	( )
	Post-Construction QC Checklist Submittal (Items 1-6)	( )
	Close-out QC Checklist Submittal (Items 1-14)	( )
Instructions: Initial each item in the space provided (|____|) verifying that the requirement has been met.		
Verify the following items for Pre-Construction, Post-Construction and Closeout QC Checklist Submittals:		
1	Contractor Design Drawing Riser Diagram includes location and types of all Control Hardware and Computer Hardware.	|____|
2	M&C Software supports, and ASHRAE 135 . M&C Software is BTL Listed as a B-AWS.	|____|
Verify the following items for Post-Construction and Closeout QC Checklist Submittal:		
3	Communication between the M&C Software and ASHRAE 135 field control systems uses only ASHRAE 135.	|____|

QC CHECKLIST			
4	Connections to non-ASHRAE 135field control systems are via a Gateway from the field control system to ASHRAE 135 or via a EMCS supported protocol without the use of a hardware Gateway.		|_____|
5	Computer workstations and servers are installed as shown on the EMCS Riser Diagram.		|_____|
6	Training schedule and course attendee lists have been developed and coordinated with shops and submitted.		|_____|
Verify the following items for Closeout QC Checklists Submittal:			
7	All points in field control systems have been discovered and are available at the M&C Software.		|_____|
8	All software has been licensed to the Government.		|_____|
9	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.		|_____|
10	Final As-built Drawings accurately represent the final installed system.		|_____|
11	Default trends have been set up (per Points Schedule drawings).		|_____|
12	Scheduling has been configured at the M&C Software (per Occupancy Schedule drawing).		|_____|
13	O&M Instructions have been completed and submitted.		|_____|

QC CHECKLIST		
14	Basic Operator and Advanced Training courses have been completed.	|_____|
	_____ _____	
	(QC Representative Signature) (Date)	

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM
08/19, CHG 3: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2019; Errata 1 2019; Errata 2-6 2020; Addenda BY-CP 2020; Addenda AF-DB 2020; Addenda A-G 2020; Addenda F-Y 2021; Errata 7-8 2021; Interpretation 1-4 2020; Interpretation 5-8 2021; Addenda AS-CB 2022) Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2021) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2020) American National Standard for

	Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2020) American National Standard for Electrical Metallic Tubing (EMT)
ANSI C80.5	(2020) American National Standard for Electrical Rigid Aluminum Conduit
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2012) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(2014) Dry-Type Transformers for General Applications
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2021) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA VE 1	(2017) Metal Cable Tray Systems
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices

NEMA WD 6	(2016) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2011; R 2017) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace
NFPA 780	(2020) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-569	(2019e) Telecommunications Pathways and Spaces
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.303	Electrical, General

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jan 2020) UL Standard for Safety Flexible Metal Conduit
UL 4	(2004; Reprint Mar 2021) UL Standard for Safety Armored Cable
UL 5	(2016; Reprint Aug 2020) UL Standard for Safety Surface Metal Raceways and Fittings
UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Mar 2021) UL Standard for Safety Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel

UL 20	(2018; Reprint Jan 2021) UL Standard for Safety General-Use Snap Switches
UL 44	(2018; Reprint May 2021) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Jul 2020) UL Standard for Safety Panelboards
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 248-12	(2011; Reprint Aug 2020) Low Voltage Fuses - Part 12: Class R Fuses
UL 360	(2013; Reprint Aug 2021) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 486A-486B	(2018; Reprint May 2021) UL Standard for Safety Wire Connectors
UL 486C	(2018; Reprint May 2021) UL Standard for Safety Splicing Wire Connectors
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Sep 2021) UL Standard for Safety Attachment Plugs and Receptacles
UL 506	(2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 510	(2020) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint May 2020) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Feb 2020) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(2011; Reprint Mar 2020) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

UL 797	(2007; Reprint Mar 2021) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 870	(2016; Reprint Mar 2019) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors
UL 1063	(2017) UL Standard for Safety Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2021) UL Standard for Safety Surge Protective Devices
UL 1561	(2011; Reprint Jun 2015) Dry-Type General Purpose and Power Transformers
UL 1569	(2018) UL Standard for Safety Metal-Clad Cables
UL 4248-1	(2017) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2018) UL Standard for Safety Fuseholders - Part 12: Class R

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

Transformers; G

Cable Trays; G

Wireways; G

SD-03 Product Data

Receptacles; G

Circuit Breakers; G

Switches; G

Transformers; G

Motor Controllers; G

Manual Motor Starters; G

Surge Protective Devices; G

Cable Trays; G

SD-05 Design Data

Cable Tray Design; G

SD-06 Test Reports

600-volt Wiring Test; G

Transformer Tests; G

Ground-fault Receptacle Test; G

SD-07 Certificates

Fuses; G

SD-09 Manufacturer's Field Reports

Transformer Factory Tests

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless

more stringent requirements are specified or indicated. NECA NEIS 1 shall be considered the minimum standard for workmanship.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

1.5.1 Electrical Systems

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

a. Single line diagram of the "as-built" building electrical system.

b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

c. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.6 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2, UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1, limited to 6 feet.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360, limited to 6 feet.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: Cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Die Cast compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC and UL 514B.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Provide receptacles as specified herein, spaced a minimum of one every 18 inches.

2.4 CABLE TRAYS

NEMA VE 1. Provide the following:

Submit cable tray design, including dimensional layout, load and seismic calculations, and fill calculations. Dimensional layout includes cable spacings, cable tray splices, and supports. Fill calculations include an index of cables for each section and identification of the lb/ft, cross sectional area, and insulation voltage class for each cable.

a. Cable trays: Form a wireway system, with a nominal depth as indicated.

b. Cable trays: Constructed of aluminum or steel that has been zinc-coated after fabrication.

c. Cable trays: Include splice and end plates, dropouts, and miscellaneous hardware.

d. Edges, fittings, and hardware: Finished free from burrs and sharp edges.

e. Fittings: Ensure not less than load-carrying ability of straight tray sections and have manufacturer's minimum standard radius.

f. Radius of bends: As indicated.

2.4.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 by 4 inch.

2.4.2 Ladder-Type Cable Trays

Provide size as indicated with maximum rung spacing of 6 inches.

2.5 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.5.1 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type 4 11/16 inches square by 2 1/8 inches deep.

b. Outlet boxes for wall-mounted telecommunications outlets: 4 by 2 1/8

by 2 1/8 inches deep.

c. Depth of boxes: Large enough to allow manufacturers' recommended conductor bend radii.

d. Outlet boxes for fiber optic telecommunication outlets: Include a minimum 3/8 inch deep single or two gang plaster ring as shown and installed using a minimum one inch conduit system.

2.6 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 1 enclosure; sheet steel, hot-dip, zinc-coated. Where exposed to wet, damp, or corrosive environments, NEMA Type as indicated.

2.7 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

2.7.1 Conductors

Provide the following:

a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.

b. Conductors No. 8 AWG and larger diameter: Stranded.

c. Conductors No. 10 AWG and smaller diameter: Solid.

d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: Stranded unless specifically indicated otherwise.

e. All conductors: Copper.

2.7.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

a. Branch circuits: No. 12 AWG.

b. Class 1 remote-control and signal circuits: No. 14 AWG.

c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.

d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.

e. Digital low voltage lighting control (DLVLC) system at 24 Volts or less: As indicated on drawings.

2.7.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.7.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.

b. Neutral conductors: White.

c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: White with a different colored (not green) stripe for each.

2.7.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

2.7.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where equipment or devices require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.7.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.7.5 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.7.6 Armored Cable

UL 4; NFPA 70, Type AC cable.

2.8 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: Insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.9 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For metal outlet boxes, plates on unfinished walls: Zinc-coated sheet steel or cast metal having round or beveled edges.

c. For nonmetallic boxes and fittings, other suitable plates may be provided.

d. Plates on finished walls: Satin finish stainless steel or brushed-finish aluminum, minimum 0.03 inch thick.

e. Screws: Machine-type with countersunk heads in color to match finish of plate.

f. Sectional type device plates are not be permitted.

g. Plates installed in wet locations: Gasketed and UL listed for "wet locations."

2.10 SWITCHES

2.10.1 Toggle Switches

NEMA WD 1, UL 20, single pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Include the following:

a. Handles: Ivory thermoplastic.

b. Wiring terminals: Screw-type, side-wired.

c. Contacts: Silver-cadmium and contact arm - one-piece copper alloy.

d. Switches: Rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.10.2 Switch with Red Pilot Handle

NEMA WD 1. Provide the following:

a. Pilot lights that are integrally constructed as a part of the switch's handle.

b. Pilot light color: Red and illuminate whenever the switch is closed or "on".

c. Pilot lighted switch: Rated 20 amps and 120 volts or 277 volts as indicated.

d. The circuit's neutral conductor to each switch with a pilot light.

2.10.3 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA enclosure as indicated per NEMA ICS 6.

2.11 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.11.1 Fuseholders

Provide in accordance with UL 4248-1.

2.11.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 248-12, Class RK-1. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.12 RECEPTACLES

Provide the following:

a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.

b. Ratings and configurations: As indicated.

c. Bodies: Ivory as per NEMA WD 1.

d. Face and body: Thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: Per NEMA WD 6.

f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.

g. Grounding pole connected to mounting strap.

h. The receptacle: Containing triple-wipe power contacts and double or triple-wipe ground contacts.

i. Controlled receptacles: As required per ASHRAE 90.1 - IP. Provide marking for controlled receptacle per NFPA 70.

2.12.1 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.13 PANELBOARDS

Provide panelboards in accordance with the following:

a. UL 67 and UL 50 having a short-circuit current rating as indicated.

b. Panelboards for use as service disconnecting means: Additionally conform to UL 869A.

c. Panelboards: Circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, obtain Government approval prior to device installation.

f. Use of "Subfeed Breakers" is not acceptable.

g. Main breaker: "separately" mounted "above" or "below" branch breakers.

h. Where "space only" is indicated, make provisions for future installation of breakers.

i. Directories: Indicate load served by each circuit in panelboard.

j. Directories: Indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).

k. Provide new directories for existing panels modified by this project as indicated.

l. Type directories and mount in holder behind transparent protective covering.

m. Panelboards: Listed and labeled for their intended use.

n. Panelboard nameplates: Provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.13.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. UL 50.

b. Cabinets mounted outdoors or flush-mounted: Hot-dipped galvanized after fabrication.

c. Cabinets: Painted in accordance with paragraph PAINTING.

d. Front edges of cabinets: Form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

e. All cabinets: Fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

f. Holes: Provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

g. Flush doors: Mounted on hinges that expose only the hinge roll to view when the door is closed.

h. Each door: Fitted with a combined catch and lock latch.

i. Keys: Two provided with each lock, with all locks keyed alike.

j. Finished-head cap screws: Provided for mounting the panelboard fronts on the cabinets.

2.13.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet. In addition to equipment grounding bus, provide second "isolated" ground bus, where indicated.

2.13.2.1 Panelboard Neutrals for Non-Linear Loads

Provide in accordance with the following:.

a. UL listed, with panelboard type specifically UL heat rise tested for use on non-linear loads.

b. Panelboard: Heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing.

c. Verification of the testing procedure: Provided upon request.

d. Two neutral assemblies paralleled together with cable is not acceptable.

e. Nameplates for panelboard rated for use on non-linear loads: Marked "SUITABLE FOR NON-LINEAR LOADS" and in accordance with paragraph FIELD FABRICATED NAMEPLATES.

f. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.13.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.13.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.13.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher per requirements of UL 943 for Class A ground-fault circuit interrupter devices.

2.14 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs): UL 508 and UL 489, and provided as shown. Provide MSCPs that consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. Rate MSCPs in accordance with the requirements of NFPA 70.

2.15 TRANSFORMERS

Provide transformers in accordance with the following:

a. NEMA ST 20, general purpose, dry-type, self-cooled, ventilated.

b. Provide transformers in NEMA 1 enclosure.

c. Taps for transformers 15 kVA and larger: Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and four 2.5 percent taps Full Capacity Below Nominal (FCBN).

d. Transformer insulation system:

(1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.

(2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 80 degrees C under full-rated load in maximum ambient of 40 degrees C.

e. Transformer of 115 degrees C temperature rise: Capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

f. Transformers: Quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.15.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in 10 CFR 431, Subpart K.

2.15.2 Transformers With Non-Linear Loads

Provide transformers for non-linear loads in accordance with the following:

a. Transformer insulation: UL recognized 220 degrees C system. Neither the primary nor the secondary temperature is allowed to exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load.

b. Transformers are to be UL listed and labeled for K-Factor rating as indicated in accordance with UL 1561.

c. Transformers evaluated by the UL K-Factor evaluation: Listed for 115 degrees C average temperature rise only.

d. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise are not acceptable.

e. K-Factor rated transformers impedance: Allowed range of 3 percent to 5 percent, with a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.16 MOTORS

Provide motors in accordance with the following:

a. NEMA MG 1.

b. Hermetic-type sealed motor compressors: Also comply with UL 984.

c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.

d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.

e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.

f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

g. Unless otherwise indicated, use continuous duty type motors if rated 1

HP and above.

h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.16.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: High efficiency types are not acceptable. In exception, for special purpose motors and motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.16.2 Premium Efficiency Polyphase and Single-Phase Motors

Select polyphase and continuous-duty single phase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10 and NEMA MG 11. In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.16.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.16.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit: Conform to the requirements specified herein. Control wiring: Provided under, and conform to, the requirements of the section specifying the associated equipment.

2.17 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

a. UL 508, NEMA ICS 1, and NEMA ICS 2.

b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.

c. Provide controllers for motors rated 1-hp and above with electronic

phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.

d. Provide protection for motors from immediate restart by a time adjustable restart relay.

e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.

f. Connections to selector switch: Wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position.

g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: Connected in motor control circuit in "hand" and "automatic" positions.

h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: Made in accordance with indicated or manufacturer's approved wiring diagram.

i. Provide selector switch with the means for locking in any position.

j. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

k. Overload protective devices: Provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.

l. Cover of combination motor controller and manual switch or circuit breaker: Interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

m. Minimum short circuit withstand rating of combination motor controller: 42,000 rms symmetrical amperes.

2.17.1 Control Wiring

Provide control wiring in accordance with the following:

a. All control wire: Stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and passing the VW-1 flame tests included in those standards.

b. Hinge wire: Class K stranding.

c. Current transformer secondary leads: Not smaller than No. 10 AWG.

d. Control wire minimum size: No. 14 AWG.

e. Power wiring for 480-volt circuits and below: The same type as

control wiring with No. 12 AWG minimum size.

f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.17.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

a. NEMA ICS 4.

b. Control circuit terminal blocks for control wiring: Molded or fabricated type with barriers, rated not less than 600 volts.

c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.

d. Terminals: Not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.

e. Terminal arrangement: Subject to the approval of the Contracting Officer with not less than four spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.

f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.

g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.17.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks: Furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: Comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: Provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.17.3 Control Circuits

Control circuits: Maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers: Conform to UL 506, as

applicable. Transformers, other than transformers in bridge circuits: Provide primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. Provide one fused secondary lead with the other lead grounded.

2.17.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.17.5 Pilot and Indicating Lights

Provide LED cluster lamps.

2.18 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single pole designed for surface mounting with overload protection and pilot lights.

2.18.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color: In accordance with NEMA ICS 2.

2.19 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303. Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

2.20 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: Outlet boxes, conduits with pull wires, wireways, cable trays, and other accessories for telecommunications outlets and pathway in accordance with TIA-569 and as specified herein. Additional telecommunications requirements are specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.21 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.22 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

a. ASTM D709.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: Identify the function and, when applicable, the position.

d. Nameplates: Melamine plastic, 0.125 inch thick, white with black center core.

e. Provide red laminated plastic label with white center core where indicated.

f. Surface: Matte finish. Corners: Square. Accurately align lettering and engrave into the core.

g. Minimum size of nameplates: One by 2.5 inches.

h. Lettering size and style: A minimum of 0.25 inch high normal block style.

2.23 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.24 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00 FIRESTOPPING.

2.25 WIREWAYS

UL 870. Material: Steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with screw-cover NEMA 1 enclosure per NEMA ICS 6.

2.26 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance and panelboards. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. SPD must have the same short-circuit current rating as the protected equipment and must not be installed at a point of system where the available fault current is in excess of that rating. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker. Submit performance and characteristic curves.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Phase to phase (L-L)
Each phase to neutral (L-N)
Neutral to ground (N-G)

Phase to ground (L-G)

SPDs at the service entrance: Provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

2.27 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: Thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: Free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: Receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: Primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: ANSI Light Gray.

g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.28 SOURCE QUALITY CONTROL

2.28.1 Transformer Factory Tests

Submittal: Include routine NEMA ST 20 transformer test results on each transformer and also provide the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

2.29 COORDINATED POWER SYSTEM PROTECTION

Prepare analyses as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: Conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid

nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: Separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: Made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors in accordance with Section 07 84 00 FIRESTOPPING.

3.1.1.1 Pull Wire

Install pull wires in empty conduits. Pull wire: Plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.1.2 Armored Cable

Install in accordance with NFPA 70, Type AC cable.

3.1.2 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.2.1 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.2.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and Schedule 80.

(1) Do not use where subject to physical damage, including but not limited to, hospitals, power plant, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

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3.1.2.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.2.4 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Plastic cable ties are not acceptable. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: Supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.2.5 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.2.6 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.2.7 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquid tight flexible nonmetallic conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections. Plastic cable ties are not acceptable as a support method.

3.1.2.8 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room: Installed and cabling length requirements in accordance with TIA-568.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling): Installed in accordance with TIA-569. Size conduits, wireways, and cable trays for telecommunications risers in accordance with TIA-569 and as indicated.

3.1.3 Cable Tray Installation

Install and ground in accordance with NFPA 70. In addition, install and ground telecommunications cable tray in accordance with TIA-569, and TIA-607. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Cable tray and tray supports must not partially nor completely obstruct access to the room. Support in accordance with manufacturer recommendations but at not more than 5 foot intervals. Adjacent cable tray sections: Bonded together by connector plates of an identical type as the cable tray sections. For grounding of cable tray system provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section, except use No. 1/0 aluminum wire if cable tray is aluminum. Terminate cable trays 10 inches from both sides of smoke and fire partitions. Install conductors run through smoke and fire partitions in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Firestop penetrations in accordance with Section 07 84 00 FIRESTOPPING. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable’s weight. Use these types of supports to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports: Suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: Cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated. Boxes in other locations: Sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: Minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: Square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lock washers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems: Minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: Minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets: A minimum of 4 11/16 inches square by 2 1/8 inches deep, except for wall mounted telephones. Mount outlet boxes flush in finished walls.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.5.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.6 Mounting Heights

Mount panelboards, circuit breakers, motor controller and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above floor or working platform or as allowed in Section 404.8 per NFPA 70. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.7.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10

AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.11 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems.

Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70.

Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.11.1 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible by exothermic weld or high compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.11.2 Resistance

Maximum resistance-to-ground of grounding system: Do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.12 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.13 Government-Furnished Equipment

Contractor rough-in for Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.14 Repair of Existing Work

Perform repair of existing work, demolition, and modification of existing electrical distribution systems as follows:

3.1.14.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.14.2 Existing Concealed Wiring to be Removed

Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.14.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.14.4 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

3.1.15 Surge Protective Devices

Connect the surge protective devices in parallel to the power source,

keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting: As specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test. Where applicable, test electrical equipment in accordance with NETA ATS.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring per NETA ATS to provide direct reading of resistance. All existing wiring to be reused must also be tested.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.

-- End of Section --

SECTION 26 28 01.00 10

COORDINATED POWER SYSTEM PROTECTION
08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 242	(2001; Errata 2003) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - Buff Book
IEEE 399	(1997) Brown Book IEEE Recommended Practice for Power Systems Analysis
IEEE 1584	(2018) Guide for Performing Arc-Flash Hazard Calculations

1.2 SYSTEM DESCRIPTION

The power system covered by this specification consists of: All new panelboards, disconnect switches, motor starters, junction boxes, pad-mounted transformer cabinets, and equipment terminations installed under this project.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fault Current Analysis

System Coordinator

Arc-Flash Hazard Analysis

1.4 QUALITY ASSURANCE

1.4.1 System Coordinator

System coordination, recommended ratings and settings of protective devices, and design analysis must be accomplished by a registered professional electrical power engineer with a minimum of 3 years of current experience in the coordination of electrical power systems.

Submit verification of experience and license number, of a registered Professional Engineer as specified above. Provide experience data consisting of at least five references for work of a magnitude comparable to this contract, including points of contact, addresses and telephone numbers.

PART 2 PRODUCTS

2.1 COORDINATED POWER SYSTEM PROTECTION

Prepare analyses to demonstrate that the equipment selected and system constructed meet the contract requirements for ratings, coordination, and protection. Include a fault current analysis. Submit the study along with protective device equipment submittals. No time extensions or similar contact modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed will be based on recommendations of this study. The Government is not responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study. The studies must be performed by a registered professional engineer with demonstrated experience in power system coordination in the last 3 years. Provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.1.1 Scope of Analyses

The fault current analysis must begin at: The source bus and extended through the secondary side of transformers for medium voltage distribution feeders.

2.1.2 Determination of Facts

Determine and document the time-current characteristics, features, and nameplate data for each existing protective device. Coordinate with the commercial power company for fault current availability at the site.

2.1.3 Single Line Diagram

Prepare a single line diagram to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point must have a unique identifier. If a fault-impedance diagram is provided, show impedance data. Show location of switches, breakers, and circuit interrupting devices on the diagram together with available fault data, and the device interrupting rating.

2.1.4 Fault Current Analysis

2.1.4.1 Method

Perform the fault current analysis in accordance with methods described in IEEE 242 and IEEE 399.

2.1.4.2 Data

Utilize actual data in fault calculations. Bus characteristics and

transformer impedance must be those proposed. Document data in the report.

2.1.4.3 Fault Current Availability

Provide balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values at each voltage transformation point and at each power distribution bus. Show the maximum and minimum values of fault available at each location in tabular form on the diagram or in the report.

2.1.5 Study Report

a. Include a narrative describing: The analyses performed; the bases and methods used.

b. Include descriptive and technical data for existing devices and new protective devices proposed. Include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

c. Document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings; and existing power system data including time-current characteristic curves and protective device ratings and settings.

d. Provide the calculation performed for the analyses, including computer analysis programs utilized. Provide the name of the software package, developer, and version number.

2.2 ARC-FLASH HAZARD ANALYSIS

2.2.1 Sub Title

Perform an arc-flash hazard analysis using an approved computer software program. Comply with IEEE 1584.

a. Utilize fault current values and device settings as determined by the studies performed within this Section.

b. Utilize as-built information including installed cable sizes and lengths, overcurrent protective devices, transformer size and impedances.

c. Provide a written report.

(1) Include description and details of incident energy and flash protection boundary calculations.

(2) Include recommendations if applicable for reducing the arc-flash energy level.

(3) Provide revised protective device settings, if included in the recommendations.

2.2.2 Sub Title

Provide equipment-specific warning labels.

2.2.2.1 Sub Title

Provide labels for all major electrical equipment. Include pad-mounted medium-voltage transformer compartments, panelboards, disconnect switches, motor controllers, and equipment terminations.

2.2.2.2 Sub Title

Labels shall be durable laminated vinyl with permanent self-adhesive, 5 inch wide by 3.5 inch high minimum size, with color warning graphics and text no smaller than 3/16 inch high.

2.2.2.3 Sub Title

Labels shall include the following information, specific for each piece of equipment:

a. Flash hazard boundary

b. Flash hazard energy level

c. PPE level

d. PPE level description

e. Equipment name

2.2.3 Sub Title

Submit arc-flash hazard analysis after installation of equipment. After approval of the arc-flash hazard analysis, readjust all protective devices to the recommended settings within the report.

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 26 29 23

ADJUSTABLE SPEED DRIVE (ASD) SYSTEMS UNDER 600 VOLTS
02/20, CHG 1: 05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

EUROPEAN COMMITTEE FOR STANDARDIZATION (CEN/CENELEC)

EN 61800-3	(2017) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 519	(2014) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61000-3-12	(2012) Electromagnetic Compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and </=75 A per phase

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 3.1	(2019) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA ICS 7	(2020) Adjustable-Speed Drives

NEMA ICS 7.2	(2015) Application Guide for AC Adjustable Speed Drive Systems
NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 61800-5-1	(2016) Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Performance Requirements

1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15 and EN 61800-3 rules and regulations, must be certified to comply with the requirements for class A computing devices and labeled.

1.3.1.2 Electromechanical and Electrical Components

Ensure electrical and electromechanical components of the Adjustable Speed Drive (ASD) do not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

1.3.2 Electrical Requirements

1.3.2.1 Power Line Surge Protection

IEEE C62.41.1 and IEEE C62.41.2, IEEE 519, IEC 61000-3-12 Control panel must have surge protection, included within the panel to protect the unit from damaging transient voltage surges. Surge protective device must be mounted near the incoming power source and properly wired to all three phases and ground. Fuses must not be used for surge protection.

1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified must be protected against surges induced on control and sensor wiring installed outdoors and as shown. Test the inputs and outputs in both normal mode and common mode using the following two waveforms:

a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Schematic Diagrams; G

Interconnecting Diagrams; G

Installation Drawings; G

Submit drawings for Government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

SD-03 Product Data

Adjustable Speed Drives; G

Wires and Cables

Equipment Schedule

Include data indicating compatibility with motors being driven.

SD-06 Test Reports

ASD Test

Performance Verification Tests

Endurance Test

SD-08 Manufacturer's Instructions

Installation instructions

SD-09 Manufacturer's Field Reports

ASD Test Plan; G

Standard Products

SD-10 Operation and Maintenance Data

Adjustable Speed Drives, Data Package 4

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

1.5 QUALITY ASSURANCE

1.5.1 Schematic Diagrams

Submit diagrams showing circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.3 Installation Drawings

Show floor plan of each site, with ASD's and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes. Submit drawings for government approval prior to equipment construction or integration. Immediately record modifications to original drawings made during installation for inclusion into the as-built drawings.

1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule must provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule must include the total quantity of each item of equipment supplied and data indicating compatibility with motors being driven. For complete assemblies, such as ASD's, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

1.5.5 Installation Instructions

Provide installation instructions issued by the manufacturer of the

equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

1.5.6 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6 DELIVERY AND STORAGE

Store delivered equipment to protect from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 WARRANTY

The complete system must be warranted by the manufacturer for a period of one year. Repair or replace any component failing to perform its function as specified and documented at no additional cost to the Government. Items repaired or replaced must be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in FAR 52.246-21 Warranty of Construction.

1.8 MAINTENANCE

1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

1.8.2 Operation and Maintenance Data

Provide in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Provide additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

1.8.3 Maintenance Support

During the warranty period, provide on-site, on-call maintenance services

by drive manufacturer's personnel on the following basis: The service must be on a per-call basis with 36 hour response. Contractor is responsible for the maintenance of all hardware and software of the system during the warranty period. Various personnel of different expertise must be sent on-site depending on the nature of the maintenance service required. Costs must include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, must be borne by the Contractor.

1.8.4 Technical Support

Provide the ASDs with manufacturer's technical telephone support in English, readily available during normal working hours.

PART 2 PRODUCTS

2.1 ADJUSTABLE SPEED DRIVES (ASD)

Provide adjustable speed drive to control the speed of induction motor(s). The ASD must include the following minimum functions, features and ratings.

a. Input circuit breaker per UL 489 with a minimum of 10,000 amps symmetrical interrupting capacity and door interlocked external operator.

b. A converter stage per UL 61800-5-1 must change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter must utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter must be insensitive to three phase rotation of the ac line and must not cause displacement power factor of less than .95 lagging under any speed and load condition.

c. An inverter stage must change fixed dc voltage to variable frequency, variable ac voltage for application to a standard NEMA MG 1 Part 30 motor designed for use with adjustable frequency power supplies. Switch the inverter to produce a sine coded pulse width modulated (PWM) output waveform.

d. The ASD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.

e. The ASD must be designed to operate from a 480 volt, plus or minus 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating.

f. Acceleration and deceleration time must be independently adjustable from one second to 60 seconds.

g. Adjustable full-time current limiting must limit the current to a preset value which must not exceed 110 percent of the controller rated current. The current limiting action must maintain the V/Hz ratio constant so that variable torque can be maintained. Short time

starting override must allow starting current to reach 175 percent of controller rated current to maximum starting torque.

h. The controllers must be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection must be included such that a failure in the controller electronic circuitry must not cause frequency to exceed 110 percent of the maximum controller output frequency selected.

i. Minimum and maximum output frequency must be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.

j. The controller efficiency at any speed must not be less than 96 percent.

k. The controllers must be capable of being restarted into a motor coasting in the forward direction without tripping.

l. Protection of power semiconductor components must be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions must not result in component failure or the need for fuse replacement:

(1) Short circuit at controller output

(2) Ground fault at controller output

(3) Open circuit at controller output

(4) Input undervoltage

(5) Input overvoltage

(6) Loss of input phase

(7) AC line switching transients

(8) Instantaneous overload

(9) Sustained overload exceeding 115 percent of controller rated current

(10) Over temperature

(11) Phase reversal

m. Solid state motor overload protection must be included such that current exceeding an adjustable threshold must activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.

n. Include slip compensation circuit that will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA MG 1 Part 30 designed for use with adjustable frequency power supplies motors to within plus or minus 0.5 percent of maximum speed without the necessity of a tachometer generator.

o. The ASD must be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The ASD must be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.

p. The ASD must include external fault reset capability. All the necessary logic to accept an external fault reset contact must be included.

q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The ASD must have a minimum of three user selectable bandwidths.

r. Provide properly sized NEMA rated by-pass and isolation contactors to enable operation of motor in the event of ASD failure and for safety transfers motor between power converter output and bypass circuit using a field-selectable automatic and manual bypass mode. Install mechanical and electrical interlocks between the by-pass and isolation contactors. Provide a selector switch and transfer delay timer. Motor overload and short circuit protective features must remain in use during the bypass mode.

s. Each individual ASD must meet the following Total Harmonic Distortion (THD) requirements at the input terminals to the factory assembly of the ASD or at the load disconnecting means serving the ASD and filter assembly. These measurements should be taken with the drive set at 90 percent frequency (rpms) and the motor under a minimum of 50 percent demand.

(1) The Voltage THD should not exceed 2.0 percent THD.

(2) The Current THD should not exceed 15.0 percent THD.

(3) If the standard factory ASD does not meet or exceed these requirements the factory must install appropriate equipment (Harmonic Traps, Filters, different Drive technology, etc.) to mitigate the distortion to assure performance of the VFD is within the limits.

t. Minimum Operating Conditions. Designed and constructed ASD's to operate within the following service conditions:

(1) Ambient Temperature Rating: 0 to 120 degrees F.

(2) Non-condensing relative humidity rating: Less than 95 percent.

(3) Ambient rating: Not exceed 1,000 feet.

2.1.1 ASD for HVAC Application

ASDs must have the following features:

a. A local operator control providing the following functions:

(1) Remote/Local operator selection with password access.

(2) Run/Stop and manual speed commands.

(3) All programming functions.

(4) Scrolling through all display functions.

b. A local operator control panel with the following data displayed:

(1) ASD status.

(2) Frequency.

(3) Motor RPM.

(4) Phase current.

(5) Scrolling through all display functions.

(6) Fault diagnostics in descriptive text.

(7) All programmed parameters.

c. Standard PI loop controller with input terminal for controlled variable and parameter settings.

d. User interface terminals for remote control of ASD speed, speed feedback, and an isolated form C SPDT relay, which energizes on a drive fault condition.

e. An isolated form C SPDT auxiliary relay which energizes on a run command.

f. An adjustable carrier frequency with 16 KHz minimum upper limit.

g. A built-in or external line reactor with 3 percent minimum impedance to protect the DC bus capacitors and rectifier section diodes.

h. Historical logging information and displays:

(1) Real-time clock with current time and date.

(2) Running log of total power versus time.

(3) Total run time.

(4) Fault log, maintaining last four faults with time and data stamp for each.

i. The ASD must be capable of automatic control by a remote 4-20 mA signal, by BACnet network command, or manually by the ASD control panel.

j. ASDs must include the following operator programmable parameters:

(1) Upper and lower limit frequency.

(2) Acceleration and deceleration rate.

(3) Variable torque volts per Hertz curve.

(4) Starting voltage level.

(5) Starting frequency level.

(6) Display speed scaling.

(7) Enable/disable soft stall feature.

(8) Motor overload level.

(9) Motor stall level.

(10) Jump frequency and hysteresis band.

(11) PWM carrier frequency.

k. ASD must have the following protective features:

(1) An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.

(2) An electronic adjustable soft stall feature, allowing the ASD to lower the frequency to a point where the motor will not exceed the full-load amperage when an overload ASD will automatically return to the requested frequency when load conditions permit.

(3) A separate electronic stall at 110 percent ASD rated current, and a separate hardware trip at 190 percent current.

(4) The ability to shut down if inadvertently started into a rotating load without damaging the ASD or the motor.

(5) The ability to keep a log of a minimum of four previous fault conditions, indicating the fault type and time of occurrence in descriptive text.

(6) The ability to sustain 110 percent rated current for 60 seconds.

(7) The ability to shutdown safely or protect against and record the following fault conditions:

(a) Over current (and an indication if the over current was during acceleration, deceleration, or running).

(b) Over current internal to the drive.

(c) Motor overload at start-up.

(d) Over voltage from utility power.

(e) Motor running overload.

(f) Over voltage during deceleration.

(g) ASD over heat.

(h) Load and ground fault.

(i) Abnormal parameters or data in ASD EEPROM.

2.2 ENCLOSURES

Provide equipment enclosures conforming to NEMA 250, NEMA ICS 7, and NEMA ICS 6, with a heater if located outdoors. An HMCP device shall provide the disconnecting means. The operating handle shall protrude through the door, but the disconnect shall not be mounted on the door. The handle shall indicate ON, OFF, and tripped conditions. The handle shall have provisions to accommodate a minimum of three padlocks in the OFF position. Interlocks shall prevent unauthorized opening or closing of the ASD door with the disconnect handle in the ON position. The door handle interlock should have provisions to be defeated by qualified maintenance personnel.

2.3 WIRES AND CABLES

All wires and cables must conform to NEMA 250, NEMA ICS 7, NFPA 70.

2.4 NAMEPLATES

Nameplates external to NEMA enclosures must conform with the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide manufacturer's standard, permanent nameplates for internal areas of enclosures.

2.5 SOURCE QUALITY CONTROL

2.5.1 ASD Test Plan

To ensure quality, each ASD must be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans.

2.5.2 ASD Test Report

To ensure quality, each ASD must be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test reports.

PART 3 EXECUTION

3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer must supervise the installation of all equipment, and wiring.

3.2 GROUNDING

Per NEMA ICS 7.2, ASD must be solidly grounded to the main distribution.

3.3 FIELD QUALITY CONTROL

Specified products must be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Conduct performance verification tests in the presence of Government

representative, observing and documenting complete compliance of the system to the specifications. Submit a signed copy of the test results, certifying proper system operation before scheduling tests.

3.3.1 ASD Test

A proposed test plan must be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests must conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. Inform the Government at least 14 working days prior to the dates of testing. Perform the ASD test with the assistance of a factory-authorized service representative.

3.3.2 Performance Verification Tests

"Performance Verification Test" plan must provide the step by step procedure required to establish formal verification of the performance of the ASD. Compliance with the specification requirements must be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. Inform the Government 14 calendar days prior to the date the test is to be conducted.

3.3.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test must commence. The system must be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness level of 0.9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. The contractor is not allowed in the building during the endurance test. The system must respond as designed.

3.4 DEMONSTRATION

3.4.1 Training

Coordinate training requirements with the Contracting Officer. Provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. Provide all training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

3.4.1.1 Instructions to Government Personnel

Provide the services of competent instructors with minimum two-year field experience with the operation and maintenance of similar ASDs who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors must be thoroughly familiar with the subject matter they are to teach. The number of training days of instruction furnished must be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase

which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals must be turned over to the Government at the end of last training session.

3.4.1.2 Operating Personnel Training Program

Provide one 2-hour training session at the site at a time and place mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

a. System overview

b. General theory of operation

c. System operation

d. Alarm formats

e. Failure recovery procedures

f. Troubleshooting

3.4.1.3 Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training must be conducted on site at a location designated by the Government. Provide a one-day training session to train four engineering personnel in the functional operations of the system. This training must include:

a. System overview

b. General theory of operation

c. System operation

d. System configuration

e. Alarm formats

f. Failure recovery procedures

g. Troubleshooting and repair

h. Maintenance and calibration

i. System programming and configuration

-- End of Section --

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SECTION 26 51 00

INTERIOR LIGHTING
05/20, CHG 2: 11/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A580/A580M	(2018) Standard Specification for Stainless Steel Wire
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B164	(2003; R 2014) Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D4674 REV A	(2002; R 2010) Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments

EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED

	Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering
ANSI/IES TM-21	(2019) Technical Memorandum: Projecting Long-Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources
IES Lighting Library	IES Lighting Library

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 77	(2017) Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination
NEMA SSL 7A	(2015) Phase-Cut Dimming for Solid State Lighting: Basic Compatibility
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 7	(2011; R 2016; R 2021) Occupancy Motion Sensors Standard

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 101	(2021) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 20	(2018; Reprint Jan 2021) UL Standard for Safety General-Use Snap Switches
UL 94	(2013; Reprint Mar 2022) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 916	(2015; Reprint Oct 2021) UL Standard for Safety Energy Management Equipment
UL 924	(2016; Reprint May 2020) UL Standard for Safety Emergency Lighting and Power Equipment
UL 1472	(2015) UL Standard for Safety Solid-State Dimming Controls
UL 1598	(2021; Reprint Jun 2021) Luminaires
UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 8750	(2015; Reprint Sep 2021) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Cybersecurity requirements are specified in Section 25 05 10.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings, must be as defined in IEEE 100 and ANSI/IES LS-1.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.

c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

d. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G

Occupancy/Vacancy Sensor Coverage Layout; G

Sequence of Operation for Lighting Control System; G

SD-03 Product Data

Luminaires; G

Light Sources; G

LED Drivers; G

Luminaire Warranty; G

Local Area Controller; G

Switches; G

Wall Box Dimmers; G

Occupancy/Vacancy Sensors; G

Power Packs; G

Power Hook Luminaire Hangers; G

Exit Signs; G

SD-06 Test Reports

ANSI/IES LM-79 Test Report; G

ANSI/IES LM-80 Test Report; G

ANSI/IES TM-21 Test Report; G

Occupancy/Vacancy Sensor Verification Test; G

SD-07 Certificates

LED Driver and Dimming Switch Compatibility Certificate; G

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES Lighting Library as applicable, for the lighting system specified.

1.5.1 Luminaire Drawings

Include dimensions, accessories installation details, and construction details. Photometric data, including CRI, CCT, LED driver type, aiming diagram, zonal lumen data, and candlepower distribution data must accompany shop drawings.

1.5.2 Luminaire Design Data

a. Provide safety certification and file number for the luminaire family that must be listed, labeled, or identified in accordance with the NFPA 70. Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

b. Provide long term lumen maintenance projections for each LED luminaire in accordance with ANSI/IES TM-21. Data used for projections must be obtained from testing in accordance with ANSI/IES LM-80.

1.5.3 ANSI/IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data in IES format as outlined under "14.0 Test Report" in ANSI/IES LM-79.

1.5.4 ANSI/IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in ANSI/IES LM-80.

1.5.5 ANSI/IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in ANSI/IES TM-21.

1.5.6 LED Driver and Dimming Switch Compatibility Certificate

Submit certification from the luminaire, driver, or dimmer switch

manufacturer that ensures compatibility and operability between devices without flickering and to specified dimming levels.

1.5.7 Occupancy/Vacancy Sensor Coverage Layout

Provide floor plans showing coverage layouts of all devices using manufacturer's product information.

1.5.8 Test Laboratories

Test laboratories for the ANSI/IES LM-79 and ANSI/IES LM-80 test reports must be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program for both LM-79 and LM-80 testing.

b. One of the qualified labs listed on the Department of Energy - LED Lighting Facts Approved Testing Laboratories List for LM-79 testing.

c. One of the EPA-Recognized Laboratories listed for LM-80 testing.

1.5.9 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70, unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.10 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products must have been in satisfactory commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.10.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.10.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

   (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

   (2) Material warranty must include:

      (a) All LED drivers and integral control equipment.

      (b) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

      (c) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) show a color shift greater than 0.003 delta u'v' from the zero hour measurement stated in the ANSI/IES LM-79 Test Report.

b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and assembly.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule and NL plates or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the driver and light source provided.

2.2.1 Luminaires

UL 8750, ANSI/IES LM-79, ANSI/IES LM-80. For all luminaires, provide:

a. Complete system with LED drivers and light sources.

b. Housings constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.

c. ANSI/IES TM-21, ANSI/IES LM-80. Minimum L70 lumen maintenance value of 50,000 hours unless otherwise indicated in the luminaire schedule. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

d. Minimum efficacy as specified in the luminaire schedule. Theoretical models of initial lamp lumens per watt are not acceptable. If efficacy values are not listed in the luminaire schedule, provide luminaires that meet the following minimum values:

Luminaire Style	Minimum Luminaire Efficacy
Recessed 1 by 4, 2 by 4, and 2 by 2	100 LPW
Recessed Downlight (fixed, adjustable, wallwash)	80 LPW
Linear, Ambient (indirect wall mount, linear pendent)	100 LPW
High Bay, Low Bay, and Industrial Locations	100 LPW

e. UL listed for dry or damp location typical of interior installations. Any luminaire mounted on the exterior of the building must be UL listed for wet location typical of exterior installations.

f. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.

g. Lenses constructed of heat tempered borosilicate glass, UV-resistant acrylic, or silicone. Sandblasting, etching and polishing must be performed as indicated in the luminaire description.

h. For all recessed luminaires that are identified to be in contact with insulation, provide luminaires that are IC-rated.

i. For all recessed luminaires that are to be installed in air plenums, require housings that are Chicago Plenum rated.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, delivered lumen output, and wattage as indicated in the luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

a. NEMA ANSLG C78.377. Emit white light and have a nominal CCT of 4000 Kelvin.

b. Minimum Color Rendering Index (CRI) of 80.

c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

d. Light source color consistency by utilizing a binning tolerance within a 3-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 8750. Provide LED drivers that are electronic, UL Class 1 or Class 2, constant-current type and that comply with the following requirements:

a. The combined driver and LED light source system does not exceed the minimum luminaire efficacy values as listed in the luminaire schedule provided.

b. Operates at a voltage of 120-277 volts at 50/60 hertz, with input voltage fluctuations of plus/minus 10 percent.

c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.

d. Maximum Total Harmonic Distortion (THD) less than 20 percent at full input power and across specified dimming range.

e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

f. Withstands Category A surges of 2 kV without impairment of performance. Provide surge protection that is integral to the driver.

g. Integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.

h. 47 CFR 15. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

i. Class A sound rating.

j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

k. Provide dimming capability as indicated in the luminaire schedule on project plans. Dimmable drivers must dim down to 10 percent. Dimmable drivers must be controlled by a Class 2 low voltage 0-10VDC controller dimming signal protocol unless otherwise specified. LED drivers of the same family/series must track evenly across multiple luminaires at all light levels.

2.5 LIGHTING CONTROLS

Provide network certification for all networked lighting control systems and devices in accordance with the requirements of Section 25 05 10 ENERGY MONITORING AND CONTROL SYSTEM (EMCS) FRONT END AND INTEGRATION. Provide lighting control systems that do not switch off battery-operated or emergency backup luminaires or exit signs in path of egress. Provide system with override of lighting control devices controlling luminaires in

path of egress with activation of fire alarm system.

2.5.1 System

Provide lighting control system that operates the lighting system as described in the lighting control strategies in the project plans. Submit Sequence of Operation for Lighting Control System describing the operation of the proposed lighting control system and devices. Sequence of Operation must provide the strategies identified in the lighting control strategies.

2.5.1.1 Localized Control Systems

Provide room or area-wide lighting control system capable of manual control, time-based control, and receiving input from photosensors and occupancy/vacancy sensors.

2.5.1.1.1 Local Area Controller

Provide controller designed for single area or room with the following requirements:

a. Operates at a voltage of 120-277 volts at 50/60 hertz.

b. 2 zone, with 2 relays rated 20 amps each with one manual dimmer per zone.

c. Provide inputs for occupancy/vacancy sensors, photosensors, and low-voltage wall switches.

d. Capable of 0-10V dimming.

e. Provide override 'ON' function with input from Fire Alarm Control Panel for all emergency lighting. Controller must not turn off power to emergency batteries or exit signs.

2.5.2 Devices

2.5.2.1 Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. When used for non-digital loads, devices must be rated at 20 Amps inductive load, and be compatible with the lighting control systems.

2.5.2.2 Wall Box Dimmers

UL 1472, UL 20, IEEE C62.41, NEMA 77, NEMA SSL 7A. Dimmers must provide flicker-free, continuously variable light output throughout the dimming range of 10 percent to 100 percent. Devices must be capable of operating at their full rated capacity regardless of being single or ganged-mounted, and be compatible with three-way and four-way switching scenarios.

Provide wall-box dimmers that meet the following requirements:

a. Device operates as part of a lighting control system.

b. Device operates with the use of a vertical slider, paddle, rotary, button, or toggle with adjacent vertical slider.

c. Finish of device matches switches and outlets in the same area.

d. Back box in wall has sufficient depth to accommodate body of switch and wiring.

e. Dimmer is capable of controlling 0-10 volt LED drivers. Dimmers and the drivers they control must be provided from the same manufacturer or tested and certified as compatible for use together.

f. Radio frequency interference suppression is integral to device.

2.5.2.3 Occupancy/Vacancy Sensors

IEEE C62.41, NEMA WD 1, UL 94, UL 916, UL 508, ASTM D4674 REV A, NEMA WD 7. Provide occupancy/vacancy sensors with coverage patterns as indicated on manufacturer shop drawings. Provide sensor types as described in the sequence of operations. Sensor locations and quantities are shown in shop drawings provided by the lighting control system manufacturer. Provide occupancy sensor operation that requires movement to activate luminaires controlled and turns luminaires off after a set time of inactivity. Provide vacancy sensor operation that requires manual control to activate luminaires and turns luminaires off after a set time of inactivity. Provide ceiling or wall-mounted occupancy/vacancy sensors that meet the following requirements:

a. Operating voltage of 12-24 volts.

b. Time delay of 30 seconds to 30 minutes with at least four intermediate time delay settings.

c. Sensors are ceiling mounted or wall-box mounted.

d. Does not exceed a maximum load requirement of 20mA at 24VDC.

e. Shielded or controlled by internal logic to adjust sensitivity to avoid false triggering due to ambient temperature, air temperature variations or HVAC air movement.

f. Sensor is equipped to automatically energize the connected load upon loss of normal power when located in a means of egress.

g. Occupancy and vacancy operation is field-adjustable and programmable via lighting control system processor.

h. No leakage current to load when in the off mode.

i. Utilize zero-crossing circuitry to prevent damage from high inrush current and to promote long life operation.

j. Allow the adding or deleting of specific luminaires or zones to the assigned sensor without the use of ladders. Provide sensors that allow for remote control adjustments of operational parameters (sensitivity, time delay), and that are be able to transmit, receive, and store system information through the lighting control system processor.

2.5.2.3.1 Passive Infrared Sensors

Provide Passive Infrared Sensors (PIR) sensors that detect occupancy by sensing heat and movement in the area of coverage. Provide sensors are constructed of a housing of high-impact, injection-molded thermoplastic. Provide PIR sensors that are temperature compensated, with a dual element sensor and a multi-element fresnel lens of POLY IR4 material.

2.5.2.3.2 Ultrasonic Sensors

Provide ultrasonic sensors that detect occupancy by sensing a change in pattern of reflected ultrasonic waves in the area of coverage. Provide sensors that are constructed of a housing of high-impact, injection-molded thermoplastic. Provide ultrasonic sensors that operate at 40 kHz.

2.5.2.3.3 Dual Technology Sensors

Provide dual technology sensors that meet the requirements for PIR sensors and ultrasonic sensors indicated above. If either the PIR or ultrasonic sensing registers occupancy, the luminaires must remain on.

2.5.2.3.4 Power Packs

UL 2043. Provide power packs to provide power to lighting control sensors as required in accordance with the manufacturer's specifications. Provide power packs that meet the following requirements:

a. Operate at an input voltage of 120-277 VAC, with an output voltage 12-24 VDC at 225 mA.

b. Constructed of plenum-rated, high-impact thermoplastic enclosure.

c. Utilizes zero-crossing circuitry to prevent damage from inrush current.

d. Maximum load rating of 16 amps for electronic lighting loads.

e. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

2.6 EXIT AND EMERGENCY LIGHTING EQUIPMENT

2.6.1 Exit Signs

UL 924, NFPA 101. Provide wattage as indicated in the luminaire schedule on project plans. Provide LED Exit Signs that meet the following criteria:

a. Housing constructed of polycarbonate housing.

b. UL listed for damp location.

c. Configured for universal mounting.

d. 6 inch high, 3/4 inch stroke red lettering on face of sign with chevrons on either side of lettering to indicate direction.

e. Single or double face as indicated in project plans and luminaire schedule.

2.7 LUMINAIRE MOUNTING ACCESSORIES

2.7.1 Suspended Luminaires

a. Provide hangers capable of supporting twice the combined weight of luminaires supported by hangers.

b. Hangers must allow luminaires to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging.

c. Single-unit suspended luminaires must have cable hangers. Multiple-unit or continuous row luminaires with a separate power supply cord must have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end.

d. Provide all linear pendent and surface mounted luminaires with two supports per four-foot section or three per eight-foot section unless otherwise recommended by manufacturer.

e. Provide rods in minimum 0.18 inch diameter.

2.7.2 Recess and Surface Mounted Luminaires

Provide access to light source and LED driver from bottom of luminaire. Provide trim and lenses for the exposed surface of flush-mounted luminaires as indicated on project drawings and specifications. Luminaires recessed in ceilings which have a fire resistive rating of one hour or more must be enclosed in a box which has a fire resistive rating equal to that of the ceiling. For surface mounted luminaires with brackets, provide flanged metal stem attached to outlet box, with threaded end suitable for supporting the luminaire rigidly in design position. Flanged part of luminaire stud must be of broad base type, secured to outlet box at not fewer than three points.

2.7.3 Luminaire Support Hardware

2.7.3.1 Wire

ASTM A641/A641M. Galvanized, soft tempered steel, minimum 0.11 inches in diameter, or galvanized, braided steel, minimum 0.08 inches in diameter.

2.7.3.2 Wire for Humid Spaces

ASTM A580/A580M. Composition 302 or 304, annealed stainless steel, minimum 0.11 inches in diameter.

ASTM B164. UNS NO4400, annealed nickel-copper alloy, minimum 0.11 inches in diameter.

2.7.3.3 Threaded Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.7.3.4 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.7.4 Power Hook Luminaire Hangers

UL 1598. Provide an assembly consisting of through-wired power hook housing, interlocking plug and receptacle, power cord, and luminaire support loop. Power hook housing must be cast aluminum having two 3/4 inch threaded hubs. Support hook must have safety screw. Luminaire support loop must be cast aluminum with provisions for accepting 3/4 inch threaded stems. Power cord must include 16 inches of 3 conductor No. 16 Type SO cord. Assembly must be rated 120 volts or 277 volts, 15 amperes.

2.8 EQUIPMENT IDENTIFICATION

2.8.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.8.2 Labels

UL 1598. All luminaires must be clearly marked for operation of specific light sources and LED drivers. The labels must be easy to read when standing next to the equipment, and durable to match the life of the equipment to which they are attached. Note the following light source characteristics in the format "Use Only _____":

a. Correlated Color Temperature (CCT) and Color Rendering Index (CRI) for all luminaires.

b. Driver and dimming protocol.

All markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.9 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum, meets requirements of corrosion-resistance testing.

PART 3 EXECUTION

3.1 INSTALLATION

IEEE C2, NFPA 70.

3.1.1 Light Sources

When light sources are not provided as an integral part of the luminaire, deliver light sources of the type, wattage, lumen output, color temperature (CCT), color rendering index (CRI), and voltage rating indicated to the project site and install just prior to project completion, if not already installed in the luminaires from the factory.

3.1.2 Luminaires

Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires and secure in accordance with manufacturers' directions and approved drawings. Provide accessories as required for ceiling construction type indicated on Finish Schedule. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed. Provide wires, straps, or rods for luminaire support in this section. Install luminaires with vent holes free of air blocking obstacles.

3.1.2.1 Suspended Luminaires

Measure mounting heights from the bottom of the luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires. Obtain architect approval of the exact mounting height on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Support suspended luminaires from structural framework of ceiling or from inserts cast into slab.

a. Provide suspended luminaires with 45 degree swivel hangers so that they hang plumb and level.

b. Locate so that there are no obstructions within the 45 degree range in all directions.

c. The stem, canopy and luminaire must be capable of 45 degree swing.

d. Rigid pendent stem, aircraft cable, rods, or chains 4 feet or longer excluding luminaire must be braced to prevent swaying using three cables at 120 degree separation.

e. Suspended luminaires in continuous rows must have internal wireway systems for end to end wiring and must be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces.

f. Utilize aligning splines on extruded aluminum luminaires to assure minimal hairline joints.

g. Support steel luminaires to prevent "oil-canning" effects.

h. Match supporting pendants with supported luminaire. Aircraft cable must be stainless steel.

i. Match finish of canopies to match the ceiling, and provide low profile canopies unless otherwise shown.

j. Maximum distance between suspension points must be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.2.2 Recessed and Semi-Recessed Luminaires

a. Support recessed and semi-recessed luminaires independently from the building structure by a minimum of two wires, straps or rods per luminaire and located near opposite corners of the luminaire. Secure horizontal movement with clips provided by manufacturer. Ceiling grid clips are not allowed as an alternative to independently supported

luminaires.

b. Support round luminaires or luminaires smaller in size than the ceiling grid independently from the building structure by a minimum of four wires, straps or rods per luminaire, spaced approximately equidistant around.

c. Do not support luminaires by acoustical tile ceiling panels.

d. Where luminaires of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support each independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the luminaire.

e. Luminaires installed in suspended ceilings must also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

f. Adjust aperture rings on all applicable ceiling recessed luminaires to accommodate various ceiling material thickness. Coordinate cut-out size in ceiling to ensure aperture covers cut-out entirely. Install aperture rings such that the bottom of the ring is flush with finished ceiling or not more than 1/16 inch above. Do not install luminaires such that the aperture ring extends below the finished ceiling surface.

g. For luminaire recessed in plaster ceilings, provide plaster frames for setting. Install setting such that the bottom of the frame is flush with finished ceiling. Support luminaires with plaster frames utilizing yokes or leveling lugs. Do not mount luminaires or support elements to ducts or pipes. Yokes must support a luminaire by no fewer than two bolts each.

3.1.3 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.4 Exit Signs

Connect exit signs on separate circuits and serve from an emergency panel. Provide only one source of control, which would be the circuit breaker in the emergency panel. Paint source of control red and provide lockout capability.

3.1.5 Lighting Controls

Refer to Section 25 05 10 ENERGY MONITORING AND CONTROL SYSTEM (EMCS) FRONT END AND INTEGRATION for additional lighting control installation requirements.

3.1.5.1 Occupancy/Vacancy Sensors

a. Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage must provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways.

b. Locate ceiling-mounted sensors no closer than 6 feet from the nearest HVAC supply or return diffuser.

c. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

3.2.1.1 Lighting Control Verification Tests

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

a. Verify occupancy/vacancy sensors operate as described in sequence of operations. Provide testing of sensor coverage, sensitivity, and time-out settings in all spaces where sensors are placed. This is to be completed only after all furnishings have been installed. Submit occupancy/vacancy sensor verification test.

b. Verify wall box dimmers and scene wallstations operate as described in sequence of operations.

3.2.1.2 Emergency Lighting Test

Interrupt power supply to demonstrate proper operation of emergency lighting. If adjustments are made to the lighting system, re-test system to show compliance with standards.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Commissioning

NFPA 101. Commission all components of the lighting system and lighting control system in accordance with Section 01 46 00.00 06 TOTAL BUILDING COMMISSIONING. Factory Trained Field Service Technician is responsible for calibration and programming sequences for input devices and systems in accordance with the requirements described in the sequence of operation.

3.3.2 Training

3.3.2.1 Maintenance Staff Training

Submit a Maintenance Staff Training Plan at least 30 calendar days prior to training session that describes training procedures for Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide on-site training which demonstrates full system functionality, assigning schedules, calibration adjustments for light levels and sensor sensitivity, integration procedures for connecting to third-party devices, and manual override including information on appropriate use. Provide protocols for troubleshooting, maintenance, repair, and replacement, and literature on available system updates and process for implementing updates.

3.3.2.2 End-User Training

Submit an End-User Training Plan at least 30 calendar days prior to training session that describes training procedures for end-users on the lighting control system. Provide users with a list of control devices

located within user-occupied spaces, such as photosensors and occupancy and vacancy sensors, including information on the proper operation and schedule for each device. Provide demonstration for each type of interface. Provide users with the building schedule as currently commissioned, including conditional programming based on astronomic time clock functionality. Provide users with the correct contact information for maintenance personnel who will be available to address any lighting control issues.

Provide laminated instructions to the user at each scene wallstation. Provide only instructions relevant to the functionality of the specific scene wallstation. Provide a description of each labeled scene control button. If the room utilizes occupancy/vacancy sensors or photosensors, include a description of this functionality on the instruction sheet.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM
08/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596	(2021) Indoor Optical Cable
ICEA S-90-661	(2021) Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communications Wiring Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568	(2006) Standard for Installing Building Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66	(2019) Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-21	(1988a; R 2012) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
TIA-526-14	(2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber

Cable Plant

TIA-568.0	(2020e) Generic Telecommunications Cabling for Customer Premises
TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-568.2	(2018d) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568.3	(2016d; Add 1 2019) Optical Fiber Cabling Components Standard
TIA-569	(2019e) Telecommunications Pathways and Spaces
TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-1152	(2016; R 2021) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
TIA/EIA-604-10	(2002a) FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)

UNDERWRITERS LABORATORIES (UL)

UL 444	(2017; Reprint Jun 2021) UL Standard for Safety Communications Cables
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 514C	(2014; Reprint Feb 2020) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(2017; Reprint Mar 2018) UL Standard for Safety Marking and Labeling Systems
UL 1286	(2008; Reprint Apr 2021) UL Standard for Safety Office Furnishings
UL 1863	(2004; Reprint Oct 2019) UL Standard for Safety Communication Circuit Accessories

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568.1, TIA-568.2, TIA-568.3, TIA-569, TIA-606 and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Drawings; G

Telecommunications Space Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Telecommunications Cabling (backbone and horizontal); G

Telecommunications Outlet/Connector Assemblies; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications Cabling Testing; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Manufacturer Qualifications; G

Test Plan; G

SD-09 Manufacturer's Field Reports

Factory Reel Tests; G

SD-10 Operation and Maintenance Data

Telecommunications Cabling and Pathway System Data Package 5; G

SD-11 Closeout Submittals

Record Documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 11 by 17 inches in size using a minimum scale of 1/8 inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Drawings

Provide registered communications distribution designer (RCDD) approved, drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure in accordance with TIA-606. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's, BD's, and FD's to the telecommunications work area outlets. The following drawings shall be provided as a minimum:

a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of

building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.

b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.

c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: The telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of

the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568.1, TIA-568.2 and TIA-568.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the

components and accessories for each cable type specified, 60 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis

during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration.

1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided. Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include only the required data fields in accordance with TIA-606. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA-606. Documentation shall include the required data fields as a minimum in accordance with TIA-606.

PART 2 PRODUCTS

2.1 COMPONENTS

Components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568.0, TIA-568.1, TIA-568.2, TIA-568.3 and NFPA 70. Provide a labeling system for cabling as required by TIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 and optical fiber cables in accordance with ICEA S-83-596 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568.1.

2.3.1.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661. Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with thermoplastic jacket color as indicated on drawings. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70.

2.3.1.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with ICEA S-83-596 and TIA-568.3. Cable shall be tight buffered, multimode, 62.5/125-um diameter laser optimized, OM2. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 40 inches.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70.Cables installed in conduit within and under slabs be UL listed and labeled for wet locations in accordance with NFPA 70. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group as indicated on drawings.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.4.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568.1, and TIA-568.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular,

constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568.2 Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568B. UTP outlet/connectors shall comply with TIA-568.2 for 200 mating cycles.

2.4.2 Optical Fiber Adapters(Couplers)

Provide optical fiber adapters suitable for duplex LC in accordance with TIA/EIA-604-10 with zirconia ceramic alignment sleeves as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with TIA-455-21 for 500 mating cycles.

2.4.3 Optical Fiber Connectors

Provide in accordance with TIA-455-21. Optical fiber connectors shall be duplex LC in accordance with TIA/EIA-604-10 with zirconia ceramic alignment sleeves compatible with 62.5/125 multimode fiber. The connectors shall provide a maximum attenuation of 0.3 dB at 850 nm with less than a 0.2 dB change after 500 mating cycles.

2.4.4 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568.1, TIA-568.2, TIA-568.3; flush design constructed of high impact thermoplastic material ivory in color to match color of receptacle/switch cover plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide labeling in accordance with the paragraph LABELING in this section.

2.5 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA-607, and NFPA 70. Components shall be identified as required by TIA-606. Provide ground rods, bonding conductors, and grounding busbars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.7 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.8 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

2.9 TESTS, INSPECTIONS, AND VERIFICATIONS

2.9.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with TIA-568.1, TIA-568.2, TIA-568.3, and TIA-526-14 for multimode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with NECA/BICSI 568, TIA-568.1, TIA-568.2, TIA-568.3, TIA-569, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling. Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

3.1.1 Cabling

Install UTP, and optical fiber telecommunications cabling system as detailed in TIA-568.1, TIA-568.2, TIA-568.3. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Install in accordance with TIA-568.1, TIA-568.2 and TIA-568.3. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

Plenum cable shall be used where open cables are routed through plenum areas. Cable routed exposed under raised floors shall be plenum rated.

Plenum cables shall comply with flammability plenum requirements of NFPA 70.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.3 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP and OFNP type cable shall be installed in a plenum.

3.1.4 Work Area Outlets

3.1.4.1 Terminations

Terminate UTP cable in accordance with TIA-568.1, TIA-568.2 and wiring configuration as specified. Terminate fiber optic cables in accordance with TIA-568.3.

3.1.4.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.4.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.4.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.5 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.6 Grounding and Bonding

Provide in accordance with TIA-607, NFPA 70 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA-606.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568.1, TIA-568.2, and TIA-568.3. Test equipment shall conform to TIA-1152. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568.1, TIA-568.2, TIA-568.3. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

3.5.1.3 Final Verification Tests

Perform verification tests for UTP systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

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SECTION 28 31 76

INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2	(2009; R 2014) Method for Measuring the Intelligibility of Speech Over Communication Systems (ASA 85)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

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	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 170	(2018) Standard for Fire Safety and Emergency Symbols

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 2, 2018) Fire Protection Engineering for Facilities

UFC 3-601-02	(2010) Operations and Maintenance: Inspection, Testing, and Maintenance of Fire Protection Systems
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems
UFC 4-021-01	(2008; with Change 1, 2010) Design and O&M: Mass Notification Systems

UNDERWRITERS LABORATORIES (UL)

UL 268	(2016; Reprint Oct 2019) UL Standard for Safety Smoke Detectors for Fire Alarm Systems
UL 268A	(2008; Reprint Oct 2014) Smoke Detectors for Duct Application
UL 464	(2016; Reprint Sep 2017) UL Standard for Safety Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
UL 497B	(2004; Reprint Dec 2012) Protectors for Data Communication Circuits
UL 521	(1999; Reprint Dec 2017) UL Standard for Safety Heat Detectors for Fire Protective Signaling Systems
UL 864	(2014; Reprint May 2020) UL Standard for Safety Control Units and Accessories for Fire Alarm Systems
UL 1283	(2017) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021) UL Standard for Safety Surge Protective Devices
UL 1480	(2016; Reprint Sep 2017) UL Standard for Safety Speakers 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	(updated online) Fire Protection Equipment Directory

1.2 RELATED SECTIONS

Refer to the following sections for related work and coordination:

Section 21 13 13 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

1.3 SUMMARY

1.3.1 Scope

a. This work includes designing and modifying the existing fire alarm/ mass notification 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, and other accessories and miscellaneous items required for a complete operational system even though each item is not specifically mentioned or described. Provide system complete and ready for operation. Existing interior fire alarm /mass notification system was manufactured by Simplex. Design and installation must comply with NFPA 72, UFC 3-600-01, UFC 4-021-01, UFC 4-010-06 and AFGM 2019-320-02.

b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with NFPA 72, except as modified herein.

c. The fire alarm system must be independent of the building security, building management, and energy/utility monitoring systems other than for control functions.

1.3.2 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. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).

d. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.

e. Signing applicable certificates under SD-07.

1.4 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions must be defined as follows:

1.4.1 Interface Device

An addressable device that interconnects hard wired systems or devices to an analog/addressable system.

1.4.2 Terminal Cabinet

A steel cabinet with locking, hinge-mounted door where terminal strips are securely mounted inside the cabinet.

1.4.3 Control Module and Relay Module

Terms utilized to describe emergency control function interface devices as defined by NFPA 72.

1.4.4 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.

1.4.5 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.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. SD-02, SD-03, and SD-06 submittals shall also be sent to Wright Patterson AFB BCE for review.

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

Fire Alarm System Site-Specific Software Acknowledgement; G

SD-02 Shop Drawings

Nameplates; G

Instructions; G

Wiring Diagrams; G

System Layout; G

Notification Appliances; G

Initiating devices; G

Amplifiers; G

Battery Power; G

Voltage Drop Calculations; G

SD-03 Product Data

Amplifiers; G

Tone Generators; G

Digitalized voice generators; G

Smoke Detectors; G

Duct Smoke Detectors; G

Heat Detectors; G

Addressable Interface Devices; G

Addressable Control Modules; G

Notification Appliances; G

Batteries; G

Battery Chargers; G

Supplemental Notification Appliance Circuit Panels; G

Auxiliary Power Supply Panels; G

Surge Protective Devices; G

Alarm Wiring; G

Back Boxes and Conduit; G

Ceiling Bridges for Ceiling-Mounted Appliances; G

Terminal Cabinets; 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

Instruction of Government Employees; G

SD-11 Closeout Submittals

As-Built Drawings

Spare Parts

1.6 SYSTEM OPERATION

Fire alarm/mass notification system including components requiring power, except for the control panels power supply, must operate on 24 volts DC unless noted otherwise in this section.

The interior fire alarm/mass notification system must be a complete, supervised, noncoded, analog/addressable fire alarm/mass notification system conforming to NFPA 72, UFC 3-600-01, UFC 4-021-01, and UL 864. The system must be activated into the alarm mode by actuation of an alarm initiating device. The system must remain in the alarm mode until the initiating device is reset and the control unit is reset and restored to normal. The system may be placed in the alarm mode by local microphones, FACU/ACU, or remotely from authorized locations/users.

1.6.1 Alarm Initiating Devices and Notification Appliances (Visual, Voice)

a. Connect alarm initiating devices to initiating device circuits (IDC) Class "B", or to signaling line circuits (SLC) Class "B" and installed in accordance with NFPA 72.

b. Connect notification appliances to notification appliance circuits (NAC) Class "B".

1.6.2 Functions and Operating Features

The system must provide the following functions and operating features:

a. Power, annunciation, supervision, and control for the system. Addressable systems must be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.

b. Visual alarm notification appliances must be synchronized as required by NFPA 72.

c. Electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control unit.

d. An audible and visual trouble signal to activate upon a single break or open condition, or ground fault. The trouble signal must also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory control unit modules. After the system returns to normal operating conditions, the trouble signal must again sound until the trouble is acknowledged. A smoke detector in the process of being verified for the actual presence of smoke must not initiate a trouble condition.

e. A trouble signal silence feature that must silence the audible trouble signal, without affecting the visual indicator.

f. Alarm functions must override trouble or supervisory functions. Supervisory functions must override trouble functions.

g. The system must be capable of being programmed from the control unit keyboard. Programmed information must be stored in non-volatile memory.

h. The system must be capable of operating, supervising, and/or monitoring non-addressable alarm and supervisory devices.

i. There must be no limit, other than maximum system capacity, as to the number of addressable devices that may be in alarm simultaneously.

j. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as HVAC, the addressable fire alarm relay must be located in the vicinity of the emergency control device.

k. An alarm signal must automatically initiate functions as indicated in the fire alarm matrix on the contract drawings.

l. A supervisory signal must automatically initiate functions as indicated in the fire alarm matrix on the contract drawings.

m. A trouble condition must automatically initiate functions as indicated in the fire alarm matrix on the contract drawings.

1.7 TECHNICAL DATA AND SITE-SPECIFIC SOFTWARE

Technical data and site-specific software (meaning technical data that relates to computer software) that are specifically identified in this

project, and may be required in other specifications, must be delivered, strictly in accordance with the CONTRACT CLAUSES. The fire alarm system manufacturer must submit written confirmation of this contract provision as "Fire Alarm System Site-Specific Software Acknowledgement". Identify data delivered by reference to the specification paragraph against which it is furnished. Data to be submitted must include complete system, equipment, and software descriptions. Descriptions must show how the equipment will operate as a system to meet the performance requirements of this contract. The site-specific software data package must also include the following:

a. Items identified in NFPA 72, titled "Site-Specific Software".

b. Identification of programmable portions of the system equipment and capabilities.

c. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

d. Provision of operational software data on all modes of programmable portions for fire alarm and mass notification.

e. Description of Fire Alarm Control Unit/Autonomous Control Unit equipment operation.

f. Description of auxiliary and remote equipment operations.

g. Library of application software.

h. Operation and maintenance manuals.

1.8 EXISTING EQUIPMENT

a. Equipment and devices must be compatible and operable with the existing fire alarm/mass notification system and must not impair reliability or operational functions of existing supervising station fire alarm system.

b. Equipment and devices must be compatible and operable with the existing building fire alarm/mass notification system. Equipment must not impair reliability or operational functions of the existing system. The existing building system control unit is a Simplex 4100ES panel.

1.9 QUALITY ASSURANCE

1.9.1 Submittal Documents

1.9.1.1 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.

1.9.1.2 Shop Drawings

Shop drawings must not be smaller than ANSI D. Drawings must comply with the requirements of NFPA 72 and NFPA 170. Minimum scale for floor plans must be 1/8"=1'.

1.9.1.3 Nameplates

Nameplate illustrations and data to obtain approval by the Contracting Officer before installation.

1.9.1.4 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 existing fire alarm control units or remote transponders, 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.

1.9.1.5 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 wattage of each speaker. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, and similar. Show/identify all acoustically similar spaces.

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.

1.9.1.6 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.

1.9.1.7 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.

1.9.1.8 Amplifiers

Calculations and supporting data to indicate that amplifiers have sufficient capacity to simultaneously drive all notification speakers at tapped settings plus 25 percent spare capacity. Annotate data for each circuit on the drawings.

1.9.1.9 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.

1.9.1.10 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.

1.9.1.11 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.

1.9.1.12 Operation and Maintenance (O&M) Instructions

Six copies of the Operation and Maintenance Instructions. The O&M Instructions must be prepared in a single volume or in multiple volumes, with each volume indexed, and may be submitted as a Technical Data Package. Manuals must be approved prior to training. The Interior Fire Alarm And Mass Notification System Operation and Maintenance Instructions must include the following:

a. "Manufacturer Data Package five" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.

b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual must include the manufacturer's name, model number, service manual, parts list, and preliminary equipment list complete with description of equipment and their basic operating features.

c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals must include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.

d. Complete procedures for system revision and expansion, detailing both equipment and software requirements.

e. Software submitted for this project on CD/DVD media utilized.

f. Printouts of configuration settings for all devices.

g. Routine maintenance checklist. The routine maintenance checklist must be arranged in a columnar format. The first column must list all installed devices, the second column must state the maintenance activity or state no maintenance required, the third column must state the frequency of the maintenance activity, and the fourth column provided for additional comments or reference. All data (devices, testing frequencies, and similar) must comply with UFC 3-601-02.

h. A final Equipment List must be submitted with the Operating and Maintenance (O&M) manual.

1.9.1.13 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.

1.9.2 Qualifications

1.9.2.1 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.

1.9.2.2 Supervisor

A NICET Level III or IV fire alarm technician 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.

1.9.2.3 Technician

Fire alarm technicians with a minimum of four years of experience must be utilized to install and terminate fire alarm/mass notification 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.

1.9.2.4 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.

1.9.2.5 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.

1.9.2.6 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.

1.9.3 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.

1.10 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.11 MAINTENANCE

1.11.1 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment must be furnished to the Contracting Officer, prior to the instruction of Government employees.

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.

2.2.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment.

2.2.3 Keys

Keys and locks for equipment, control units and devices must be identical.

2.3 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS

Any amplifiers, preamplifiers, tone generators, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 must be housed in a remote transponder, terminal cabinet, or in the FACU/ACU. Individual amplifiers must be 100 watts maximum.

2.3.1 Operation

The system must automatically operate and control all building speakers.

2.3.2 Construction

Amplifiers must utilize computer grade solid state components and must be provided with output protection devices sufficient to protect the amplifier against any transient up to 10 times the highest rated voltage in the system.

2.3.3 Inputs

Equip each system with separate inputs for the tone generator, digitalized voice driver and control unit mounted microphone. Microphone inputs must be of the low impedance, balanced line type. Both microphone and tone generator input must be operational on any amplifier.

2.3.4 Tone Generator

The tone generator must produce a three-pulse temporal pattern and must be constantly repeated until interrupted by either the digitalized voice message, the microphone input, or the alarm silence mode as specified. The tone generator must be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay. The tone generator must be provided with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces.

2.3.5 Protection Circuits

Each amplifier must be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component must cause illumination of a visual "amplifier trouble"

indicator on the control unit, appropriate logging of the condition in the history log, and other actions for trouble conditions as specified.

2.4 SMOKE DETECTORS

2.4.1 Spot Type Detectors

Provide addressable photoelectric smoke detectors as follows:

a. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors must be listed for use with the FACU/ACU.

b. Provide self-restoring type detectors that do not require any readjustment after actuation at the FACU/ACU to restore them to normal operation. The detector must have a visual indicator to show actuation.

c. Vibration must have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen must not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases with screw terminals for each conductor. The detectors must maintain contact with their bases without the use of springs.

e. The detector address must identify the particular unit, its location within the system, and its sensitivity setting. Detectors must be of the low voltage type rated for use on a 24 VDC system.

2.4.2 Duct Smoke Detectors

Duct-mounted addressable photoelectric smoke detectors must consist of a smoke detector, as specified in paragraph Spot Type Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry must be mounted in a metallic or plastic enclosure exterior to the duct. It is not permitted to cut the duct insulation to install the duct detector directly on the duct. Detectors must be listed for operation over the complete range of air velocities, temperature and humidity expected at the detector when the air-handling system is operating. Detectors must be powered from the FACU/ACU.

a. Sampling tubes must run the full width of the duct. The duct detector package must conform to the requirements of NFPA 90A, UL 268A, and must be listed for use in air-handling systems. The control functions, operation, reset, and bypass must be controlled from the FACU.

b. Lights to indicate the operation and alarm condition must be visible and accessible with the unit installed and the cover in place. Remote indicators must be provided where required by NFPA 72. Remote indicators as well as the affected fan units must be properly identified in etched plastic placards.

c. Detectors must provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Auxiliary contacts provide for this function must be located within 3 feet of the

controlled circuit or appliance. The auxiliary contacts must be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.5 HEAT DETECTORS

2.5.1 Heat Detectors

Heat detectors must be analog/addressable and designed for detection of fire by combination fixed temperature and rate-of-rise principle in accordance with UL 521. The alarm condition must be determined by comparing detector value with the stored values. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70 must be types approved for such locations.

2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors must be surface mounted in the horizontal orientation and supported independently of wiring connections. Detectors must be self-resetting. Detector must operate at 135 degrees F. Detector must feature rate compensation. Detectors rated to operate at 135 degrees F must not respond to momentary temperature fluctuations less than 30 degrees F per minute between 60 and 100 degrees F.

2.6 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored must be configured as a Class "B" initiating device circuits. The module must be listed as compatible with the control unit. The module must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. Monitor module must contain an integral LED that flashes each time the monitor module is polled and is visible through the device cover plate. Existing fire alarm system initiating device circuits must be connected to a single module to supervise the circuit. Modules must be listed for the environmental conditions in which they will be installed.

2.7 ADDRESSABLE CONTROL MODULES

The control module must be capable of operating as a relay (dry contact form C) for interfacing the control unit with other systems. The module must be listed as compatible with the control unit. The indicating device or the external load being controlled must be configured as Class B notification appliance circuits. The system must be capable of supervising, audible, visual and dry contact circuits. The control module must have both an input and output address. The supervision must detect a short on the supervised circuit and must prevent power from being applied to the circuit. The control model must provide address setting means compatible with the control unit's SLC supervision and store an internal identifying code. The control module must contain an integral LED that flashes each time the control module is polled and is visible through the device cover plate. Control Modules must be listed for the environmental conditions in which they will be installed.

2.8 NOTIFICATION APPLIANCES

2.8.1 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 white. Recessed audible appliances must be installed with a grill that is painted white.

2.8.1.1 Speakers

a. Speakers must conform to the applicable requirements of UL 1480. Speakers must have six different sound output levels and operate with audio line input levels of 70.7 VRMs and 25 VRMs, by means of selectable tap settings. Interior speaker tap settings must include taps of 1/4, 1/2, 1, and 2 watt, at a minimum. Speakers must incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400 Hz to 4,000 Hz, and must have a sealed back construction. Speakers must be capable of installation on standard 4-inch square electrical boxes. Where speakers and strobes are provided in the same location, they may be combined into a single unit. All inputs must be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the FACU/ACU.

b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge or molded high impact plastic and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes must be ground and finished to provide a smooth and neat appearance for each plate. Each plate must be primed and painted.

c. Speakers must utilize screw terminals for termination of all field wiring.

2.8.2 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 15 candela based on the UL 1971 test. Strobe must be surface mounted.

2.9 ELECTRIC POWER

2.9.1 Primary Power

Power must be 120 VAC 60 Hz service for the FACU/ACU from the AC service to the building in accordance with NFPA 72.

2.10 SECONDARY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power must be automatic and must not cause transmission of a false alarm.

2.10.1 Batteries

Provide sealed, maintenance-free, sealed lead acid batteries as the source for emergency power to the FACU/ACU, NAC, or AMP panels as required to

meet the power demands of the new appliances. Batteries must contain suspended electrolyte. The battery system must be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.10.1.1 Capacity

Battery size must be the following capacity. This capacity applies to every control unit associated with this system, including supplemental notification appliance circuit panels, and auxiliary power supply panels.

a. Sufficient capacity to operate the fire alarm system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.

b. Sufficient capacity to operate the mass notification for 60 minutes after loss of AC power.

2.10.1.2 Battery Power Calculations

a. Verify that battery capacity exceeds supervisory and alarm power requirements for the criteria noted in the paragraph "Capacity" above.

(1) Substantiate the battery calculations for alarm and supervisory power requirements. Include ampere-hour requirements for each system component and each control unit component, and compliance with UL 864.

(2) Provide complete battery calculations for both the alarm and supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

(3) Provide voltage drop calculations to indicate that sufficient voltage is available for proper operation of the system and all components. Calculations must be performed using the minimum rated voltage of each component.

b. For battery calculations assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Using 20.4 VDC as starting voltage, perform a voltage drop calculation for circuits containing device and/or appliances remote from the power sources.

2.10.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger must be capable of providing 120 percent of the connected system load and must maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger must recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

2.11 SURGE PROTECTIVE DEVICES

Surge protective devices must be provided to suppress all voltage transients which might damage fire alarm control unit components. Systems having circuits located outdoors, communications equipment must be protected against surges induced on any signaling line circuit. Cables and conductors, that serve as communications links, must have surge protection circuits installed at each end. The surge protective device must wire in series to the power supply of the protected equipment with screw terminations. Line voltage surge arrestor must be installed directly adjacent to the power panel where the FACU breaker is located.

a. Surge protective devices for nominal 120 VAC must be UL 1449 listed with a maximum 500 volt suppression level and have a maximum response time of 5 nanoseconds. The surge protective device must also meet IEEE C62.41.1 and IEEE C62.41.2 category B tests for surge capacity. The surge protective device must feature multi-stage construction and be provided with a long-life indicator lamp (either light emitting diode or neon) which extinguishes upon failure of protected components. Any unit fusing must be externally accessible.

b. All surge protective devices (SPD) must be the standard product of a single manufacturer and be equal or better than the following:

   (1) For 120 VAC nominal line voltage: UL 1449 and UL 1283 listed, series connected 120 VAC, 20A rated, surge protective device in a NEMA 4x enclosure. Minimum 50,000 amp surge current rating with EMI/RFI filtering and a dry contact circuit for remote monitoring of surge protection status.

   (2) For 24-volt nominal line voltage: UL 497B listed, series connected low voltage, 24-volt, 5A rated, loop circuit protector, base and replaceable module.

2.12 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.12.1 Alarm Wiring

IDC and SLC wiring must be solid copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring must be No. 18 AWG size conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, must be copper No. 16 AWG size conductors at a minimum. Speaker circuits must be copper No. 16 AWG size twisted and shielded 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 Battery Cabinets

When batteries will not fit in the FACU/ACU, locate battery cabinets below or adjacent to the FACU/ACU. Battery cabinets must be installed at an accessible location when standing at floor level. Battery cabinets must not be installed lower than 12 inches above finished floor, measured to the bottom of the cabinet, nor higher than 36 inches above the floor, measured to the top of the cabinet. Installing batteries above drop ceilings or in inaccessible locations is prohibited. Battery cabinets must be large enough to accommodate batteries and also to allow ample gutter space for interconnection of control units as well as field wiring. The cabinet must be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions. The cabinet must be identified by an engraved phenolic resin nameplate. Lettering on the nameplate must indicate the control unit(s) the batteries power and must not be less than 1-inch high.

3.2.2 Notification Appliances

Locate notification appliance devices as required by NFPA 72 and to meet the intelligibility requirements. 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. Audible and visual notification appliances mounted in acoustical ceiling tiles must be centered in the tiles plus or minus 2 inches.

3.2.3 Smoke Detectors

Locate detectors as required by NFPA 72 and their listing on a 4-inch mounting box. Install heat detectors not less than 4 inches from a side wall to the near edge. Heat detectors located on the wall must have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. Smoke detectors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. Install smoke detectors no closer than 3 feet from air handling supply diffusers. Detectors installed in acoustical ceiling tiles must be centered in the tiles plus or minus 2 inches.

3.2.4 Ceiling Bridges

Provide ceiling bridges for ceiling-mounted appliances. Ceiling bridges must be as recommended/required by the manufacturer of the ceiling-mounted notification appliance.

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/ACU 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 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size must be appropriate for the size of the wiring to be connected. Conductor terminations must be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection must be permanently mounted in the terminal cabinet. Minimum size is 8 inches by 8 inches. Only screw-type terminals are permitted. Provide an identification label, that displays "FIRE ALARM TERMINAL CABINET" with 2-inch lettering, on the front of the terminal cabinet.

3.3.3 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/ACU.

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).

3.3.4 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. Galvanized rigid steel (GRS) conduit must be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate metal conduit (IMC) may be used in lieu of GRS as allowed by NFPA 70.

b. Electrical metallic tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. Use die-cast compression connectors.

c. For rigid metallic conduit (RMC), only threaded type fitting are permitted for wet or damp locations.

d. Flexible metal conduit is permitted for initiating device circuits 6 feet in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use liquid tight flexible metal conduit in damp and wet locations.

3.3.5 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets and the FACU/ACU 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/ACU, and remote FACU/ACU 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 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

Maintain existing fire alarm/mass notification equipment fully operational until the new equipment has been tested and accepted by the Contracting Officer. As new equipment is installed, label it "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, it must be placed in service and connected to the supervising station. Remove tags from new equipment and tag the existing equipment "NOT IN SERVICE" until removed from the building.

a. After acceptance of the new system by the Contracting Officer, remove existing equipment not connected to the new system, remove unused exposed conduit, and restore damaged surfaces. Remove the material from the site and dispose.

b. Disconnect and remove the existing fire alarm/mass notification systems where indicated on the contract drawings.

c. Control units and fire alarm/mass notification devices and appliances disconnected and removed must be turned over to the Contracting Officer.

d. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items.

3.5 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire-rated walls, partitions with fire-rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

3.6 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.

c. Painting must comply with Section 09 90 00 PAINTS AND COATINGS.

3.7 FIELD QUALITY CONTROL

3.7.1 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, and reviewed by the QFPE 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, signaling line devices and circuits, control devices/equipment, batteries, power sources/supply, 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 forma 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), Voice Notification System Circuits (NAC Audio), and Signaling Line Circuits (SLC).

b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how 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.

3.7.2 Pre-Government Testing

3.7.2.1 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. Intelligibility test results with marked-up floor plans.

f. Documentation that all tests identified in the paragraph "Minimum System Tests" are complete.

3.7.2.2 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 have been completed and tested to confirm communications are fully functional. Submit request for test at least 15 calendar days prior to the requested test date.

3.7.3 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.

3.7.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

a. The manufacturer's technical representative.

b. The Contractor's Qualified Fire Protection Engineer (QFPE).

c. Marked-up red line drawings of the system as actually installed.

d. Loop resistance test results.

e. Complete program printout including input/output addresses.

f. Copy of pre-Government Test Certificate, test procedures and completed test data forms.

g. Audibility test results with marked-up floor plans.

h. Intelligibility test results with marked-up floor plans.

Government Final Tests will be witnessed by the Contracting Officer's Representative (COR) and Qualified Fire Protection Engineer (QFPE). At this time, any and all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.8 MINIMUM SYSTEM TESTS

3.8.1 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 software control and data files have been entered or programmed into the FACU/ACU. Hard copy records of the software must be provided to the Contracting Officer.

k. Verify that red-line drawings are accurate.

l. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

m. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

n. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke detectors must be conducted using real smoke or the use of canned smoke which is permitted.

o. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

p. 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".

3.8.2 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.

3.8.3 Intelligibility Tests

Intelligibility testing of the System must be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, and ASA S3.2. Following are the specific requirements for intelligibility tests:

a. Intelligibility Requirements: Verify intelligibility by measurement after installation.

b. Ensure that a CIS value greater than the required minimum value is provided in each area where building occupants typically could be found. The minimum required value for CIS is .8. Rounding of values is permitted.

c. Take measurements near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate).

d. The distance the occupant must walk to the location meeting the minimum required CIS value must be measured on the floor or other walking surface as follows:

(1) Along the centerline of the natural path of travel, starting from any point subject to occupancy with less than the minimum required CIS value.

(2) Curving around any corners or obstructions, with a 12 inches clearance there from.

(3) Terminating directly below the location where the minimum required CIS value has been obtained.

Use commercially available test instrumentation to measure intelligibility as specified by NFPA 72 as applicable. Use the mean value of at least three readings to compute the intelligibility score at each test location.

3.9 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.

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.

In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be permitted until the as-built drawings and O&M manuals are received.

3.10 INSTRUCTION OF GOVERNMENT EMPLOYEES

3.10.1 Instructor

Provide the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the operation, inspection, testing, and maintenance of the system provided. The instructor must train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm system. The instructor must be thoroughly familiar with

all parts of this installation. The instructor must be trained in operating theory as well as in practical O&M work. Submit the instructors information and qualifications including the training history.

3.10.2 Required Instruction Time

Provide 8 hours of instruction after final acceptance of the system. The instruction must be given during regular working hours on such dates and times selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training must allow for rescheduling for unforeseen maintenance and/or fire department responses.

3.10.2.1 Technical Training

Equipment manufacturer or a factory representative must provide 1 day of on site. Training must allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises.

3.10.3 Technical Training Manual

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training must familiarize designated Government personnel with proper operation of the installed system. The maintenance training course must provide the designated Government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

3.11 EXTRA MATERIALS

3.11.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system must be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During the warranty period, the service technician must be on-site within 24 hours after notification. All repairs must be completed within 24 hours of arrival on-site.

During the warranty period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturer. Installing fire alarm contractor is NOT responsible for any damage resulting from abuse, misuse, or neglect of equipment by the end user.

3.11.2 Spare Parts

Spare parts furnished must be directly interchangeable with the corresponding components of the installed system. Spare parts must be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts must be delivered to the Contracting Officer at the time of the Government testing and must be accompanied by an inventory list.

3.11.3 Document Storage Cabinet

Upon completion of the project, but prior to project close-out, place in the document storage cabinet copies of the following record documentation:

a. As-built shop drawings.

b. Product data sheets.

c. Design calculations.

d. Site-specific software data package.

e. All documentation required by SD-06.

-- End of Section --

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