SOLICITATION, OFFER, AND AWARD *(Construction, Alteration, or Repair)*	1. SOLICITATION NO. RFP080062	2. TYPE OF SOLICITATION ☐ SEALED BID (IFB) ☒ NEGOTIATED (RFP)	3. DATE ISSUED 07/08/2008	

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

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. SB 070187	6. PROJECT NO. 950042E-G

7. ISSUED BY CODE 9901	8. ADDRESS OFFER TO
AOC - Procurement Division 2nd & D Streets, SW Room H2-263 WASHINGTON, DC 20515	AOC - Procurement Division 2nd & D Streets, SW Room H2-263 WASHINGTON, DC 20515

9. FOR INFORMATION CALL:	a. NAME Fred Witcher	b. TELEPHONE NO. (Include area code)(NO COLLECT CALLS) 202-226-7092

SOLICITATION

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

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

** SEE SUPPLEMENTARY INFORMATION FOR CONTRACT TIME/SUBMITTAL SCHEDULE. REQUESTS FOR DRAWINGS MUST BE SUBMITTED TO THE CONTRACTING OFFICER AT: fwitcher@aoc.gov.

11. The Contractor shall begin performance 20 calendar days and complete it within ** calendar days after receiving ☒ award, ☐ notice to proceed. This performance period is ☒ mandatory ☐ negotiable. *(See **SUPPLEMENTARY INFORMATION**)*

12a. 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 20

13. ADDITIONAL SOLICITATION REQUIREMENTS

a. Sealed offers in original and 3 copies to perform the work required are due at the place specified in item 8 by 13:00 (hour) local time 08/20/2008 (date). If this is a sealed bid solicitation, offers will 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

d. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

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.)
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 requirement stated in Item 13d. Failure to insert any number means the offeror accepts the minimum in Item 13d.)

AMOUNTS

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

19. ACKNOWLEDGMENT OF AMENDMENTS

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 27	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 9901	27. PAYMENT WILL BE MADE BY
AOC - Procurement Division 2nd & D Streets, SW Room H2-263 WASHINGTON, DC 20515	Architect of the Capitol Accounting Division Ford House Office Bldg. Rm. H2-205 Washington, DC 20515

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 requirements 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 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 futher 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) Frederick Witcher, Jr.

30b. SIGNATURE	30c. DATE	31b. UNITED STATES OF AMERICA BY	31c. DATE

Summary Info Continuation Page

Dirksen Senate Office Building (DSOB) Infrastructure Improvements Phase I - Task No. 9

BASE

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
1	BASE BID 1 (South Stack)	Total : 1.00	JB	$	$
	Description: Remove/Replace Existing AHU's in accordance with the attached specifications and drawings.				
2	BASE BID 2 - Commissioning Services for CLIN 1 (South Stack)	Total : 1.00	JB	$	$
	Description:				
11	BASE BID 3 - Asbestos Testing, South, Center and North Stacks	Total : 1.00	JB	$	$
	Description:				
12	BASE BID 4 - Additional asbestos removal	Total : 1.00	CF	$	$
	Description:				
13	BASE BID 5 - Lead-based paint testing, South, Center, and North Stacks	Total : 1.00	JB	$	$
	Description:				
14	BASE BID 6 - Lead-based paint removal	Total : 1.00	SF	$	$
	Description:				

Lump-Sum Price for Base $

OPTION 1

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
3	Option 1 (Center Stack)	Total : 1.00	JB	$	$
	Description: Remove/Replace Existing AHU's in accordance with the attached specifications and drawings (to be awarded by 30 Sept 09)				

Lump-Sum Price for Option 1 $

OPTION 2

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
4	Option 2 (Center Stack)	Total : 1.00	JB	$	$
	Description: Remove/Replace Existing AHU's in accordance with the attached specifications and drawings (to be awarded by 30 Sept 10)				

Lump-Sum Price for Option 2 $

OPTION 3

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
5	Commissioning Services for Option 1 (CLIN 3)	Total : 1.00	JB	$	$
	Description: To be awarded by 30 Sept 09				

Lump-Sum Price for Option 3 $

OPTION 4

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
6	Commissioning Services for Option 2 (CLIN 4)	Total : 1.00	JB	$	$
	Description: To be awarded by 30 Sept 10				

Lump-Sum Price for Option 4 $

OPTION 5

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
7	Option 5 (North Stack)	Total : 1.00	JB	$	$
	Description: Remove/Replace Existing AHU's in accordance with the attached specifications and drawings (to be awarded by 30 Sept 10)				

Lump-Sum Price for Option 5 $

OPTION 6

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
8	Option 6 (North Stack)	Total : 1.00	JB	$	$
	Description: Remove/Replace Existing AHU's in accordance with the attached specifications and drawings (to be awarded by 30 Sept 11)				

Lump-Sum Price for Option 6 $

OPTION 7

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
9	Commissioning Services for Option 5 (CLIN 7)	Total : 1.00	JB	$	$
	Description: To be awarded by 30 Sept 10				

Lump-Sum Price for Option 7 $

OPTION 8

Number	Commodity Name	Quantity	Unit of Issue	Unit Price ($)	Total Cost ($, Inc. disc)
10	Commissioning Services for Option 6 (CLIN 8)	Total : 1.00	JB	$	$
	Description: To be awarded by 30 Sept 11				

Lump-Sum Price for Option 8 $

Lump-Sum Price for All Options $

Lump-Sum Price for Base and All Options $

B1 ADDITIONAL INFORMATION

The work includes all labor, material, equipment and incidentals for the Dirksen Infrastructure Improvements - Phase I, Task 9, Washington, D.C., as defined in the General Conditions, Solicitation Conditions, Supplementary Conditions, Representations and Certifications, Specification Sections 01000 thru 16510, Drawings and all attachments.

Offerors shall propose a price for all items listed in the Schedule. Offerors who fail to propose a price for each item on the Schedule will be rejected.

This work is intended to be completed in phases. If Options 1, 2, 3, 4, 5, 6, 7 and/or 8 are awarded, the work for these options shall be completed in the time frames stated in the Supplementary Information page. Upon award of these options the submittal and review process shall be performed concurrently with previously awarded work. Actual construction work and the related commissioning services for these options shall commence after completion of previously awarded work.

If any option is awarded, said option will be awarded by the due date indicated in the respective Line Item description.

The Government will evaluate the following to determine the best value to the Government by:

a. Adding all Base bids (Line Items 1, 2, 11, 12, 13 and 14),

b. Adding all Options items (Line Items 3 thru 10), and

c. Evaluation of all technical evaluation factors.

General Conditions

52.211-12 Liquidated Damages--Construction(Sept 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 **SEE SUPPLEMENTARY INFORMATION** 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)

52.223-3 Alt I Hazardous Material Identification and Material Safety Data (Jan 1997)- Alternate I (July 1995)

(a) "Hazardous material," as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, list None)	Identification No.
NONE	

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph

(b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with paragraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(i) Except as provided in paragraph (i)(2), the Contractor shall prepare and submit a sufficient number of Material Safety Data Sheets (MSDS's), meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous materials identified in paragraph (b) of this clause.

(1) For items shipped to consignees, the Contractor shall include a copy of the MSDS's with the packing list or other suitable shipping

document which accompanies each shipment. Alternatively, the Contractor is permitted to transmit MSDS's to consignees in advance of receipt of shipments by consignees, if authorized in writing by the Contracting Officer.

(2) For items shipped to consignees identified by mailing address as agency depots, distribution centers or customer supply centers, the Contractor shall provide one copy of the MSDS's in or on each shipping container. If affixed to the outside of each container, the MSDS's must be placed in a weather resistant envelope.

(End of clause)

52.225-9 Buy American Act--Construction Materials (Jan 2005)

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

"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.

"Domestic construction material" means--

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

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

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

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

(b) *Domestic preference.*

(1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by providing a preference for domestic construction material. 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 the construction material or components listed by the Government as follows:

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. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(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 Act 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 Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(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			

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]

[Include other applicable supporting information.]

[Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).]*

(End of clause)

52.236-5 Material and Workmanship (Apr 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements (Apr 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

52.242-14 Suspension of Work (Apr 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed-

(1) For any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and

(2) Unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

52.252-2 Sec. I CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

52.252-2CLAUSES 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):

www.gsa.gov or www.arnet.gov

(End of clause)

AOC52.202-2 Definitions - Construction (Jun 2004)

(a) The term Government means the United States of America, represented by the Architect of the Capitol, who is the Contracting Officer.

(b) The term head of the agency means the Committee, Commission, or other authority of the Legislative Branch of the Government having final jurisdiction or supervision over the work involved. The other authority as used in this paragraph includes the Architect of the Capitol in cases in which he has final jurisdiction or supervision over the work involved.

(c) The term Architect as used in the contract documents shall mean the Architect of the Capitol.

(d) The term Contracting Officer as used in the contract documents means the Architect of the Capitol or his duly authorized

representative.

(e) The term his duly authorized representative means any person or persons or board authorized to act for the head of the agency within the scope of their authority.

(f) The term Contractor means the individual, partnership or corporation entering into a contract with the Government to perform the work specified.

(g) The term Subcontractor , as used in this part, means any supplier, distributor, vendor, or firm that furnishes supplies or services to or for a prime contractor or other subcontractor. There is no privity of contract between the Government and the Subcontractors.

(h) The term Project Director means the individual designated by the Architect to monitor the progress of work from a technical standpoint. The duties and responsibilities of the Project Director shall include supervision of scheduling, receipt and verification of Contractor s payrolls in accordance with the Davis Bacon Act, coordination between Divisions, concerning resolution and/or avoidance of potential problems and, to the extent authorized by the Delegation of Authority, if any, issuance of clarifications, supplemental agreements and change orders to the Contractor.

(i) The term contract documents includes, collectively, the Project Manual, the contract drawings and the addenda and modifications thereto, if any.

(j) The term work includes, but is not limited to, materials, labor, and manufacture and fabrication of components.

(k) The term specifications means the portion of the Contract Documents that consist of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

(l) The term drawings means the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, that show the design, location and dimensions of the Work, and generally includes plans, elevations, sections, details, schedules and diagrams.

(m) Wherever in the specifications or upon the drawings the word directed, required, ordered, designated, prescribed, or words of like import are used, it shall be understood that the direction, requirement, order, designation, or prescription, of the Contracting Officer is intended and similarly the words approved, acceptable, satisfactory, or words of like import shall mean approved by or acceptable to, or satisfactory to the Contracting Officer, unless otherwise expressly stated.

(n) Where as shown, as indicated, as detailed, or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word provided as used herein shall be understood to mean provide complete in place, that is furnished and installed.

(End of clause)

AOC52.203-1 Advertising/Promotional Materials (Dec 2005)

(a) It is the policy of the Congress to discourage contractors providing services and supplies to the Legislative Branch entities, including the Architect of the Capitol, from advertising practices that feature the Capitol and Capitol Complex in a manner in which conveys, or is reasonably calculated to convey, a false impression of sponsorship, approval or endorsement of any product or service by the Congress, the Government of the United States, or any Department, Agency or instrumentality thereof.

(b) Contractors performing construction services for Legislative Branch entities, including the Architect of the Capitol, are discouraged from capitalizing on their contractual relationships with such entities and shall not engage in advertising practices which convey, or are reasonably calculated to convey, a false impression of sponsorship, approval or endorsement of any product or service by the Congress, the Government of the United States, of any Department, Agency or instrumentality thereof. This includes utilizing, in conjunction with the fact of their contractual relationship, images of the Capitol, any other buildings in the Capitol Complex, or any part of the United States Capitol Grounds in their advertising or promotional materials; and/or publishing or disseminating the aforementioned advertising or promotional materials.

(c) The Contractor, by signing this contract, agrees to comply with the foregoing and to submit any proposed advertising or promotional copy connected in any manner with this contract and/or the Capitol, other Capitol Complex Buildings, or the United States Capitol Grounds to the Contracting Officer for approval prior to publication.

(d) If this solicitation is for supplies or services, including construction, to be provided to or performed for the United States Supreme Court, the Contractor, by signing this contract, agrees that he or she will not advertise the award of the contract in his/her commercial advertising in such a manner as to state or imply that the Supreme Court of the United States endorses a product, project, or commercial line of endeavor.

(End of clause)

AOC52.203-2 Disclosure of Information to the General Public (Jun 2004)

(a) Promptly after receiving any request from the general public for information on or data derived from this contract, the contractor shall notify the Architect of the Capitol, Procurement Division. The contractor shall cooperate with the Procurement Division in compiling or collecting information or data if the Architect of the Capitol determines the information or data to be releasable.

(b) General public, for purposes of this clause, are those groups or individuals who are not authorized by law or regulation to have access.

(c) This clause is not intended to prevent the contractor from providing contract information or data which the contractor is required to provide in order to conduct its business, such as insurance, banking, subcontracting.

(d) The contractor is permitted to request that proprietary information or data not be released if such release would harm or impair the contractor in conducting its normal business. Such request must be documented with clear and specific grounds for that claim.

(End of clause)

AOC52.204-1 Printed or Copied Double-sided on Recycled Paper (Jun 2004)

The Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied doubled-sided on recycled paper and meet minimum content standards when not using electronic commerce methods to submit information or data to the Government.

(End of clause)

AOC52.204-4 Personal Identity Verification of Contractor Personnel (Sep 2007)

(a) By entering into this contract, the Contractor agrees to comply with all Federal laws that apply to the Contractor's activities, including but not limited to the U.S. Citizenship and Immigration Services' requirement to maintain a signed copy of I-9 Employment Eligibility Verification for each employee in accordance with 8 U.S.C. 1324(a).

(b) The Employment Eligibility Verification Program (E-Verify), operated by the Department of Homeland Security and the Social Security Administration, allows U.S. employers to verify name, date of birth, and Social Security Number, as well as immigration information for non-citizens, against Federal databases in order to verify the employment eligibility of both citizen and non-citizen new hires. All contractors receiving AOC contracts are strongly encouraged to use this program to verify the status of their personnel. Information about the program can be obtained at www.dhs.gov/E-Verify or by calling 1-888-464-4218.

(c) The Contractor shall insert this clause in all subcontracts when the subcontractor is required to have physical access to a Federally-controlled facility or access to a Federal information system.

(End of clause)

AOC52.211-3 Deficiencies in Contract Documents (Jun 2004)

The Contractor shall promptly inform the Contracting Officer, in writing, of any discovered errors, omissions, discrepancies, conflicts or ambiguities in the contract documents before proceeding with any work affected by such factors. Failure to do so will be at the risk of the Contractor.

(End of clause)

AOC52.211-6 Notice to Proceed (Jun 2004)

A formal notice, or notices, to proceed will be issued as soon as practical, normally after approval by the Contracting Officer of the bonds and insurance. Unless specifically authorized in writing, any steps taken in connection with the performance of, or the preparation to perform, the contract, prior to issuance of the notice to proceed, will be the responsibility of and at the risk of the Contractor, and without any cost whatsoever to the Government.

(End of clause)

AOC52.215-10 Examination of Records (Jun 2004)

(a) The Contractor agrees that the Architect of the Capitol or any duly authorized representatives shall, until the expiration of 3 years after final payment under this contract, have access to and the right to examine any books, accounting procedures and practices documents, papers, records and other data regardless of whether such items are in written form, in the form of computer data or in any other form and other supporting evidence, involving transactions related to this contract or compliance with any clause or certification thereunder.

(b) The Contractor further agrees to include in all its subcontracts hereunder a provision to the effect that subcontractor agrees that the Architect of the Capitol or any authorized representatives shall, until the expiration of 3 years after final payment under the subcontract, have access to and the right to examine books, documents, papers, records other data regardless of whether such items are in written form, in the form of computer data or in any other form, and other supporting evidence, involving transactions related to the subcontract or compliance with any clause or certification thereunder.

(c) The term subcontract as used in this clause excludes purchase orders not exceeding $10,000.

(End of clause)

AOC52.215-11 Audits (Jun 2004)

(a) If the price of this contract is changed through the operation of any of the provisions of this contract, the Contractor, within such reasonable time as the Contracting Officer may direct, shall submit complete and accurate cost and pricing data in support of any claim asserted under such provisions.

(b) With the submission of cost and pricing data the Contractor shall supply the following certification by a duly authorized corporate officer, partner, or owner, as applicable:

"This is to certify that, to the best of my knowledge and belief, the cost and pricing data herewith submitted to the Contracting Officer in support of a price adjustment under Supplement/Claim No. for _____ (identify by description) are accurate and complete and they are current as of _____ (date).

Date of Execution _____

Firm _____

Signature_____

Title_____"

(c) The Contracting Officer in accordance with the FAR clause Audit and Records - Negotiation , 52.215-2, has the right to examine all books, records, documents and other data of the Contractor or subcontractor in order to evaluate the accuracy, completeness, and currency of cost or pricing data thus submitted. The Contractor shall insert an appropriate provision in all subcontracts for the purpose of making the requirements of this paragraph applicable thereto.

(End of clause)

AOC52.219-1 Utilization of Small Business Concerns (Aug 2004)

(a) It is the policy of the Government as declared by the Congress that a fair proportion of the purchases and contracts for supplies and services for the Government be placed with all types of small business concerns as determined by the size standards in 13 CFR 121.

(b) The Contractor agrees to accomplish the maximum amount of subcontracting to all types of small business concerns that the Contractor finds to be consistent with the efficient performance of this contract.

(End of clause)

AOC52.219-3 Small Business Subcontracting Plan (Nov 2007)

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause -

"Individual contract plan" means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract or task order at or over $1,000,000, and has goals that are based on the Contractor's planned subcontracting in support of the specific contract.

"Subcontract" means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor calling for supplies or services required for performance of the contract or subcontract.

(c) Within ten (10) calendar days after award of the contract, the Contractor shall submit an individual subcontracting plan that separately addresses subcontracting with small business, small disadvantaged business, HUBZone small business, veteran-owned small business, service-disabled veteran-owned small business, and women-owned small business concerns. The minimum goals that the AOC views as attainable in the District of Columbia metropolitan area are available on on www.aoc.gov/business/index.cfm.

(d) The Contractor's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of the small business concerns listed in (c) above;

(2) A statement of -

(i) Total dollars planned to be subcontracted to large business concerns;

(ii) Total doallars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns;

(iv) Total dollars planned to be subcontracted to HUBZone small business concerns;

(v) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(vi) Total dollars planned to be subcontracted to service-disabled veteran-owned small business concerns;

(vii) Total dollars planned to be subcontracted to women-owned small business concerns;

(viii) Total dollars planned to be subcontracted to all concerns;

(3) Assurances that the Contractor will -

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the contractor with the subcontracting

plan;

(iii) Submit AOC Form 294, Subcontracting Report for Individual Contracts. The report shall provide information on subcontract awards to small business conncers listed in (c) above. Reporting shall be in accordance with the instructions on the form or as provided in agency regulations;

(iv) Assist all business concerns listed in (c) above by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedulules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, small disadvantaged business, HUBZone small business, veteran-owned small business, service-disabled veteran-owned small business, and women-owned small businceess subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an oportunity to compete over a period of time; and

(v) Confirm that a subcontractor representing itself as a HUBZone small business concern is identified as a certified HUBZone small business concern by accessing the Central Contractor Registration (CCR) database.

(e) The Contractor shall submit the following report:

(1) AOC Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract.

(f) The subcontracting goals as established by the Architect of the Capitol are listed on the AOC internet site at www.aoc.gov under the sub-listing of "Procurement".

(End of clause)

AOC52.222-3 Convict Labor (Jun 2004)

In connection with the performance of work under this contract the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, approved September 10, 1965, 18 U.S.C. 4082(c)(2).

(End of clause)

AOC52.222-4 Overtime Work (Aug 2004)

No extra reimbursement will be allowed for work performed outside regular working hours or on Saturdays, Sundays, or holidays and, for work performed in the District of Columbia, Presidential Inauguration Day, unless such work is authorized by the Contracting Officer; and provided such work is not otherwise required to be performed under the terms of the contract. If said authorization is verbal, with written verification thereof by signature of the Contracting Officer on the employee's weekly time record (see AOC52.232-2, Payments - Services or AOC52.232-3, Payments - Services Utilizing Time Records).

(End of clause)

AOC52.222-7 Workmen's Compensation Laws (Jun 2004)

The Contractor and his subcontractors employed on the site shall comply with the Workmen's Compensation Laws of the District of Columbia.

(End of clause)

AOC52.223-1 Hazardous Material Identification and Material Safety Data - Supplement (Jun 2005)

(a) Except as provided in paragraph (c), the Contractor shall prepare and submit a sufficient number of Material Safety Data Sheets (MSDS s), meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous materials identified in FAR 52.223-3(b).

(b) For items shipped to consignees, the Contractor shall include a copy of the MSDS s with the packing list or other suitable shipping document which accompanies each shipment. Alternatively, the Contractor is permitted to transmit MSDS s to consignees in advance of receipt of shipments by consignees, if authorized in writing by the Contracting Officer.

(c) For items shipped to consignees identified by mailing address as agency depots, distribution centers or customer supply centers, the Contractor shall provide one copy of the MSDS in or on each shipping container. If affixed to the outside of each container, the MSDS s must be placed in a weather resistant envelope.

(d) For items provided to a construction site, the contractor shall provide two copies of each MSDS. One copy shall be provided to the COTR in accordance with the Division 1 submittal requirements, and a second copy shall be kept in an MSDS binder on the job site.

(End of clause)

AOC52.223-3 Security Markings (Jun 2004)

(a) Before dissemination to subcontractors or other personnel, all AOC drawings and electronic copies thereof shall be considered at a minimum to be sensitive but unclassified (SBU). The following statement shall be imprinted on each page of drawings:

PROPERTY OF THE UNITED STATES GOVERNMENT

COPYING, DISSEMINATING, OR DISTRIBUTING THESE DRAWINGS, PLANS OR SPECIFICATIONS TO UNAUTHORIZED USERS IS PROHIBITED

Do not remove this notice

Properly destroy documents when no longer needed

(b) The following paragraph shall be included on the cover page of the information (such as the cover page on a set of construction drawings and on the cover page of the specifications).

PROPERTY OF THE UNITED STATES GOVERNMENT

COPYING, DISSEMINATING, OR DISTRIBUTING THESE DRAWINGS, PLANS OR SPECIFICATIONS TO UNAUTHORIZED USERS IS PROHIBITED

Do not remove this notice

Properly destroy documents when no longer needed

(End of clause)

AOC52.223-4 Transmission or Posting of Drawings/Specifications (Jun 2004)

Due to security issues, the contractor is strictly prohibited from placing or transmitting drawings and specifications on the internet or modem without express permission from the Architect of the Capitol.

(End of clause)

AOC52.225-1 Buy American Act - Supplement (Jun 2004)

In addition to provisions of the above clause entitled, Buy American Act, the General Provisions of the Legislative Branch Appropriations Act provides in part, as follows:

(a) It is the sense of the Congress that, to the greatest extent practicable, all equipment and products purchased with funds made available in the Act should be American-made.

(b) In providing financial assistance to or entering into any contract with, any entity using funds made available in the Act, the head of each Federal Agency, to the greatest extent practicable, shall provide to such entity a notice describing the statement made in Paragraph (a) above, by the Congress.

(End of clause)

AOC52.228-2 Insurance - Work on a Government Installation (May 2008)

(a) The Contractor shall, at his own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance as required in this clause.

(b) Within 20 calendar days after the date of contract award or before commencing work under this contract, whichever is earlier, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. A Certificate of Insurance showing the contract number and evidencing the Contractor's compliance with the requirements of this clause, identifying all policies of insurance and sureties proposed for the provision of liability coverage pertinent to the work of the instant contract, including the endorsement required in this paragraph, and manually countersigned by an authorized representative of the insurance company shall be submitted in accordance with the time frame stated in this paragraph. All policies for liability protection, bodily injury, or property damage shall include the United States of America, acting by and through the Architect of the Capitol, as an additional insured with respect to operations under this contract. Each policy of insurance shall contain the following endorsement, which may be attached as a rider:

"It is understood and agreed that the Contractor's Insurance Company or surety shall notify the Architect of the Capitol, in writing, thirty (30) calendar days in advance of the effective date of any reduction in or cancellation of this policy."

(c) Insurance and required minimum liability limits are:

(1) Appropriate bodily injury and property damage liability insurance, with limits of not less than $500,000 for each occurrence and $2,000,000 for annual aggregate, including requirements for protection of hoisting and scaffolding operations, when applicable, and servicing areas adjacent to the building;

(2) Automobile bodily injury liability insurance with limits of not less than $200,000 for each person and $500,000 for each accident, and property liability insurance, with a limit of not less than $20,000 for each accident. A combined single limit for these coverages is acceptable; and/or

(3) Workmen's compensation insurance as required by the laws of (1) the District of Columbia for work performed on a Government

site located in the District of Columbia; (2) the State of Maryland for work performed on a Government site located in Maryland; or (3) the Commonwealth of Virginia for work performed on a Government site located in Virginia.

(d) The Contractor shall insert the substance of this clause, including this paragraph, in subcontracts under this contract that require work on a Government installation, and shall require subcontractors to provide and maintain the insurance required in this clause. The Contractor shall maintain a copy of all subcontractors proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

AOC52.228-4 Indemnification and Hold Harmless Agreement (Jun 2004)

The Contractor agrees to indemnify and hold the Government harmless against any and all claims for damages to persons or property from any cause or causes whatsoever arising out of the performance of services covered by the contract; including, but not limited to, errors, omissions or negligent acts of the Contractor, but excluding active negligence of the Government, and against any and all costs, expenses, attorney's fees, and liability incurred by the Government in defending against such claims, whether the same proceed to judgement or not. In the prosecution of any successful claim or suit by the Government for the enforcement of this contract, the Contractor shall reimburse the Government for any reasonable attorney's fees and costs of claim or suit incurred by the Government.

(End of clause)

AOC52.228-5 Payment Protection and Performance Bonds - Construction (Dec 2006)

(a) Payment protection and performance bonds. (1) For a new definitive contract (one containing no provisions for issuance of task orders) or purchase order, payment protection and performance bonds, if required, shall be provided by the contractor after notice of award of the contract.

(2) For indefinite-delivery contracts, the contractor has the option of providing --

(i) Payment protection and performance bonds for the total estimated amount of the contract within the time frame as specified elsewhere in the contract; or

(ii) Payment protection and performance bonds upon the issuance of each task order under the contract and as determined by the value of the instant task order within the time frame as specified elsewhere for the instant task order.

(b) Required bonds. (1) A performance bond is not required if the original contract, purchase order, or task order amount is $100,000 or less.

(2) A performance bond (Standard Form 25) is required if the original contract, purchase order, or task order amount exceeds $100,000. The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract, purchase order, or task order amount.

(3) Payment protection is not required if the original contract, purchase order, or task order amount is $30,000 or less.

(4) Payment protection is required if the original contract, purchase order, or task order is greater than $30,000. The penal amount of payment protection at the time of award shall be 100 percent of the original contract, purchase order, or task order amount. See FAR 52.228-13, Alternative Payment Protections, for the types of acceptable payment protection.

(c) Irrevocable letter of credit. If an irrevocable letter of credit is used, FAR 52.228-14, Irrevocable Letter of Credit, is applicable and can be found at http://www.arnet.gov/far/index.html.

(d) Additional bond protection. (1) The Government may require additional performance and payment bond protecction if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(2) The Government may secure the additional protection by directing the Contractor to increase the penal amount of hte existing bonds or to obtain an additional bond.

(e) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified elsewhere in the contract or order or prior to commencing work, whichever is sooner.

(f) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, or by other acceptable security such as postal money order, certified check, cashier s check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 3700 East West Highway Room 6F01, Hyattsville MD 20782 or via the internet at http://www.fms.treas.gov/c570.

(g) Notice of subcontractor waiver of protection (40 U.S.C. 270 b(c). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(h) Upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

AOC52.228-6 Notice to Sureties (Jun 2004)

The final inspection and acceptance of the work included in this contract shall not be binding or conclusive upon the Government if it shall subsequently appear that the Contractor has willfully or fraudulently, or through collusion with the representatives of the Government in charge of the work, supplied inferior material or workmanship, or has departed from the terms of the contract, or if defects of any kind should develop during the period that the guarantees covering such material and workmanship are in force. In such event, the Government shall have the right, notwithstanding such final acceptance and payment, to have the work removed and to cause the work to be properly performed and satisfactory material supplied to such extent as, in the opinion of the Contracting Officer, may be necessary to finish the work in accordance with the drawings, if any, and specifications, at the expense of the Contractor and the sureties on its bond, and the Government shall have the right to recover against the Contractor and its sureties the cost of such work, together with such other damages as the Government may suffer because of the default of the Contractor in the premises, the same as though such acceptance and final payment had not been made.

(End of clause)

AOC52.232-4 Payments - Construction (Sep 2005)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, or estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor s request for progress payments shall including the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested;

(ii) A listing of the amount included for work performed by each subcontractor under the contract;

(iii) A listing of the total amount of each subcontract under the contract;

(iv) A list of the amounts previously paid to each such subcontractor under the contract; and

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete Paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification.

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor s performance.

(Name)_____

(Title) _____

(Date) _____

(d) Retainage. In making such progress payments, there shall be retained 10 percent of the estimated amount until final completion and acceptance of all work required by the contract. However, if the Contracting Officer, at any time after 50 percent of the work has been completed, finds that satisfactory progress is being made, he may authorize any of the remaining partial payments to be made in full. Also, whenever the work is substantially complete, the Contracting Officer, if he considers the amount to be retained to be in excess of the amount adequate for the protection of the Government, at his discretion, may release to the Contractor all or a portion of such excess amount. Furthermore, on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made therefore without retention of a percentage. Retainage under any contract action awarded by the Architect functioning in the capacity as a Contracting Officer for the

agency shall be released by the Architect rather than an administrative Contracting Officer.

(e) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(f) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor s claims to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(g) Invoices shall be issued monthly as defined in Paragraph (b) in which services are performed by the Contractor. Properly certified invoices shall be FAXED to the Architect of the Capitol, Accounting Division at (202) 226-2580. Information concerning requirements for payment requisitions must be secured by telephoning the Accounting Officer at (202) 226 2552. Payment will be made on a monthly basis. To assist the AOC in making timely payments, the Contractor is requested to furnish the following additional information on the invoice:

(1) Contract Number;

(2) Name and address of Contractor;

(3) Invoice Date;

(4) Period the payment covers; and

(5) Amount by line item as identified in the Schedule.

(h) Each invoice shall be in accordance with the SCHEDULE OF SUPPLIES OR SERVICES AND PRICES/COSTS FOR CONSTRUCTION completed during the payment period. The Contractor shall keep accurate time records for each of his personnel employed in the work, and information copies of the Contractor's time records (payrolls) shall be submitted with each invoice for payment. Original certified copies of Contractor s payrolls shall have been submitted weekly in arrears to the Contracting Officer in accordance with the Davis Bacon Act.

(i) Payments will be made directly to your financial institution through Direct Deposit/Electronic Funds Transfer (DD/EFT). The Contractor s attention is directed to the requirements of AOC52.232-6, Payment By Electronic Funds Transfer - Other than Central Contractor Registration.

(End of clause)

AOC52.232-6 Payment by Electronic Funds Transfer - Other than Central Contractor Registration (Jun 2004)

(a) Method of payment.

(1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT) except as provided in paragraph (a)(2) of this clause. As used in this clause, the term "EFT" refers to the funds transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the contractor agrees to either

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to delay payment until such time as the Government makes payment by EFT (but see paragraph (d)).

(b) Mandatory submission of Contractor s EFT information. (1) The Contractor is required to provide the Government with the information required to make payment by EFT (see paragraph (i) of this clause). The contractor shall provide this information directly to the office designated in paragraph (k) to receive that information (hereafter: "designated office") by three working days after notification of contract award. If not otherwise specified in this contract, the payment office is the designated office for receipt of the contractor s EFT information. If more than one designated office is named for the contract, the contractor shall provide a separate notice to each office. In the event that the EFT information changes, the contractor shall be responsible for providing the updated information to the designated office(s).

(2) If the contractor provides EFT information applicable to multiple contracts, the contractor shall specifically state the applicability of this EFT information in terms acceptable to the designated office. However, EFT information supplied to a designated office shall be applicable only to contracts that identify that designated office as the office to receive EFT information for that contract.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment.

(1) Notwithstanding the provisions of any other clause of this contract, the Government is not required to make any payment under this contract until after receipt, by the designated payment office, of the correct EFT payment information from the Contractor. Until receipt of the correct EFT information, any invoice or contract financing request shall be deemed not to be a valid invoice.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than the 30 days after its receipt by the designated office to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the changed EFT information is implemented by the payment office.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor provided EFT information in the correct manner, the Government remains responsible for--

(i) Making a correct payment; and

(ii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because Contractor s EFT information was incorrect at the time of Government release or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment and the provisions of paragraph (d) shall apply.

(f) EFT and assignment of claims. If the contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the contractor shall require as a condition of any such assignment that the assignee shall provide the EFT information required by paragraph (i) of this clause to the designated office and shall be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the contractor. EFT information that shows the ultimate recipient of the transfer to be other than the contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of Paragraph (d) of this clause.

(g) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information provided by the contractor s financial agent.

(h) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address in the contract.

(i) EFT Information. The contractor shall provide the following information to the designated payment office. The contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause). The Contractor shall designate a single financial agent per contract capable of receiving and processing the EFT information using the EFT methods described in paragraph (c) of this clause. The information required is as follows:

(1) The contract number;

(2) The contractor s name and remittance address as stated in the contract(s);

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the contractor s official authorized to provide this information;

(4) The name, address, and 9 digit Routing Transit Number of the contractor s financial agent; and

(5) The contractor s account number and the type of account (checking, saving or lockbox).

(j) The Contractor shall send all EFT information, and any changes to EFT information to the office designated in paragraph (k) of this clause. The Contractor shall not send EFT information to the payment office, or any other office than that designated in paragraph (k). The Government need not use any EFT information sent to any office other than that designated in paragraph (k).

(k) Designated office:

Name:

Architect of the Capital

Accounting Division

Mailing Address:

2nd and D Streets SW

Ford House Office Building

Washington, DC 20515

Telephone:

(202) 226-2552

Facsimile:

(202) 225-7321

(End of clause)

AOC52.232-12 Assignment - Supplement (Sep 2004)

Neither the contract nor any interest therein shall be assigned. However, moneys due or to become due under the contract may be assigned in accordance with the provisions of FAR clause 52.232-23 (ASSIGNMENT OF CLAIMS) as incorporated by reference in Section I.

(End of clause)

AOC52.233-1 Disputes (Mar 2008)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) and as modified by Section 1501 of Title I of Division H of the Consolidated Appropriations Act, 2008, Pub. L. 110-161. (31 U.S.C. 702 NOTE).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding $50,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer. For the purposes of this clause, all final decisions shall be rendered by the Architect of the Capitol's Director or Deputy Director, Procurement Division.

(2)(i) The Contractor shall provide the certification specified in paragraph (d)(2)(iii) of this clause when submitting any claim exceeding $50,000.

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of $50,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over $50,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer s decision shall be final unless the Contractor appeals, within ninety days of receipt of a Contracting Officer s decision, to the Government Accountability Office Contract Appeals Board, 441 G Street NW, Room 7182, Washington, DC 20548; facsimile 202-512-9749 or e-mail CAB@gao.gov.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor s specific reasons for rejecting the offer.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the contract, and comply with any decision of the Contracting Officer.

(End of clause)

AOC52.233-2 Claims for Equitable Adjustments - Waiver and Release of Claims (Jun 2004)

(a) Whenever the Contractor submits a claim for equitable adjustment under any paragraph of this contract which provides for equitable adjustment of the contract, such claim shall include all types of adjustments in the total amounts to which the paragraph entitles the Contractor, including but not limited to adjustments arising out of delays or disruptions or both caused by such

change. Except as the parties may otherwise expressly agree, the Contractor shall be deemed to have waived (1) any adjustments to which it otherwise might be entitled under the paragraph where such claims fail to request such adjustments, and (2) any increase in the amount of equitable adjustments additional to those requested in its claim.

(b) Further, the Contractor agrees that, if required by the Contracting Officer, he will execute a release, in form and substance satisfactory to the Contracting Officer, as part of the supplemental agreement setting forth the aforesaid equitable adjustment, and that such release shall discharge the Government, its officers, agents and employees, from any further claims, including but not limited to further claims arising out of delays or disruptions or both, caused by the aforesaid change.

(End of clause)

AOC52.233-3 Limitation on Damages for Delay (Jun 2004)

(a) The Architect shall not be obligated or liable to the Contractor for, and the Contractor hereby expressly waives any claims against the Architect on account of any damages, of any nature whatsoever, which the Contractor, or its subcontractor at any tier may incur as a result of delays, interferences, disruptions, suspensions, changes in sequence or the like arising from or out of any act or omission of the Architect, it being understood and agreed that the Contractor's sole and exclusive remedies in such event shall be a reimbursement of direct costs necessarily incurred as a result of the foregoing causes, and an extension of the contract time, but only in accordance with the provisions of the Contract Documents.

(b) For the purposes of this clause, the term "Damages" shall include all indirect and/or impact costs which shall include, without limitation: unabsorbed Home Office Overhead (including calculations under the "Eichleay Formula"), Idle Labor and Equipment, Loss of Productivity, and Interest; the term "Damages" shall not include on-site direct costs, which shall include direct labor (superintendence, labor, time-keeping, and clerical work) direct materials and supplies (including material handling), direct equipment, restoration and cleanup, overhead and profit (but only as permitted under the clauses Changes and Changes - Supplement, taxes, insurance, and bonding costs, which will be calculated in accordance with the clauses Changes and Changes - Supplement. Provided, however, that the accounting practice of treating these costs as "direct" shall be in accordance with

(1) The Contractor's established and consistently followed cost accounting practices for all work; and

(2) FAR Cost Accounting Cost Principles and Procedures (FAR Part 31).

(c) To the extent that any other provision of this contract provides for the payment of damages, as defined in this clause, to the Contractor and is thus inconsistent with the provisions of this clause, such other provision will be superseded hereby with respect to the issue of damages.

(End of clause)

AOC52.236-1 Access to Work (Jun 2004)

(a) The Contracting Officer or his representative may visit and inspect the Contractor's plant, without advance notice, at any time during the course of this contract, and he shall be granted every available assistance to facilitate such inspection.

(b) The Contracting Officer and proper members of his staff shall at all times have access to the work, and the Contractor shall provide proper and safe facilities for such access and for inspection.

(End of clause)

AOC52.236-2 Other Contracts and Work (Jun 2004)

(a) The Contractor shall fully inform himself as to conditions relating to construction and labor under which other work, if any, is being performed, or is to be performed, by or for the Government, by contract or otherwise, where such work may affect or be affected by, operations under this Contract.

(b) Notwithstanding the performance by other parties of work at the site during performance of this contract, the Contractor shall prosecute the work diligently and continuously, and he shall cooperate in every way with such other parties. The Contractor shall give such other parties, to the extent their work is affected by his work, all information necessary for the proper execution of their work, without delay. The Contractor shall so arrange and conduct his work that other parties may complete their work at the site according to schedule. All other work under the instant contract shall be carefully coordinated with work under such other contracts.

(End of clause)

AOC52.236-3 Accident Prevention and Safety and Health Programs - Construction (Sep 2004)

(a) The Contractor shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others and comply with the safety and health standards published in 41 C.F.R. Part 50-205, including any matters incorporated by reference therein. He shall also be responsible for all materials delivered and work performed until completion and final acceptance of the entire contract work, except for any completed unit thereof which theretofore may have been finally accepted.

(b) Williams-Steiger Occupational Safety and Health Act. The Contractor shall also comply in all aspects of the job with the regulations issued by the Secretary of Labor pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970, as set forth

in Title 29 of the Code of Federal Regulations. The Contractor shall bring to the attention of the Architect any work encountered which may involve entry into a suspected confined space as defined by OSHA. A determination will be made by the Architect, and if the area is deemed a permit required confined space, additional protective measures will be needed, per OSHA requirements.

(c) National Fire Protection Association standards. The Contractor shall comply with all applicable standards of the National Fire Protection Association relative to fire prevention, except to the extent that more exacting requirements are specified or imposed by the Contracting Officer. The Contractor shall keep and properly maintain fire prevention devices at the job site and shall take all possible precautions deemed necessary by the Government representative in charge of the work.

(d) Protection of property and persons. (1) The Contractor shall protect all of his material and work at the site, whether incorporated in the work or not, against damage or loss from any cause, and he shall take all necessary precautions against damage to all other work and material on the site. He shall provide and maintain necessary safeguards for protection of his employees, Government employees and the public generally, and he shall take all other proper precautions for their protection against injury. He shall comply with all directives and regulations of the Contracting Officer and other proper authorities relative to the use of public property.

(2) The Contractor shall protect all electric, telephone, computer facilities, water, gas, sewer, steam and other underground utility lines, in sidewalks, streets or other areas in, under or around the site, to the satisfaction of the Contracting Officer, the Government of the District of Columbia, and all other authorities having jurisdiction.

(3) The performance of work at the site by other parties shall not relieve the Contractor from any liability for loss or damage or from his obligations under this contract. No agreement or arrangement between the Contractor and others as to a division or proportionate share of liability for loss or damage incurred, or of the cost of insurance, shall in any way relieve the Contractor of such liability or his obligations under this contract.

(e) The Contractor shall comply with the requirements of FAR 52.236.13, Accident Prevention. In the event that conditions on the site pose an imminent danger or threat to the Contractor s workers, the public, Government employees, other persons, or to Capitol complex structures and property of historical significance, the Contracting Officer can verbally order the Contractor to suspend work operations in the specified area until said conditions are corrected to the Contracting Officer s satisfaction. The Contracting Officer shall promptly issue a written order to suspend the work to the Contractor formalizing the specifics of the verbal suspension of work.

(f) The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(End of clause)

AOC52.236-4 Cutting and Patching (Jun 2004)

Prior to initiation of the work operations of either cutting or patching, as a necessary requirement of the work under this contract, of any structural component or of lintels, stair systems, piping, duct work, vessels, equipment and like items in the building, the Contractor shall consult with the Contracting Officer and follow explicitly his directions and stated requirements concerning methods, materials, the manner in which the work is performed, and the level of competence and skill possessed by Contractor's employees, or those of subcontractors, who are proposed to be employed in said cutting and/or patching operations.

(End of clause)

AOC52.236-5 Cleaning and Restoring (Jun 2004)

(a) The contractor shall remove dirt and debris resulting from the operations under this contract daily.

(b) The Contractor shall, as a condition precedent to the final acceptance of the work, remove from the site of the work all remaining plant, installations, temporary barricades, temporary facilities, equipment, tools, materials, refuse, rubbish and waste, used or accumulated in connection with, but not incorporated in, the work, unless otherwise specified or directed, and he shall leave the buildings, grounds, streets, and all public places occupied by him in a thoroughly clean, neat and satisfactory condition.

(End of clause)

AOC52.236-8 Scheduling of Work (Aug 2004)

(a) The Contractor shall, before commencing work on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of partial payments until the Contractor submits the required schedule.

(b) The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours as necessary to insure prosecution of work in accordance with the approved schedule. If, in the opinion of the Contracting Officer, the Contractor falls behind in the scheduled progress, the Contractor shall take such steps as may be 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 in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. The provisions of this subparagraph shall not be construed as prohibiting work on Saturdays, Sundays and holidays and, for work performed in the District of Columbia, Presidential Inauguration Day, if the Contractor so elects and if approved.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause 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 this contract.

(End of clause)

AOC52.236-9 Schedule of Values (Jun 2004)

(a) The Contractor shall, in accordance with the requirements of the Contracting Officer, prepare and submit for approval a schedule of estimated values of all parts of the work, and shall submit such quantity breakdowns pertinent thereto as the Contracting Officer may deem necessary for the proper checking of partial payment requisitions and for other administrative purposes. The total of the schedule of values shall equal the amount of the contract. The values employed in making this schedule will be used only for determining partial payments; they will not be used as a basis for determining an increase or decrease in the contract price. The listings and subdivisions of this schedule for estimated costs and quantity breakdowns shall be as approved by the Contracting Officer.

(b) The submission and approval of the schedule of values shall be a condition precedent to the making of partial payments.

(End of clause)

AOC52.236-10 Specifications and Drawings for Construction (Feb 2007)

(a) The Contractor shall keep on the site of the work a copy of the drawings and specifications, and of approved shop drawings, product data and samples and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, or in case of discrepancy either within the figures, within the drawings, or within the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information he considers necessary, unless otherwise provided.

(b) Shop drawings means drawings submitted to the Government by the Contractor, subcontractor, any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., form, fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract.

(c) The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (c); and

(5) Reproduce and print contract drawings and specifications as needed.

(d) In general--

(1) Large scale drawings shall govern small scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(e) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(f) The work shall conform to the specifications and the contract drawings included as part of this contract.

(g) The Contractor shall submit to the Contracting Officer for approval shop drawings, product data and samples as required under the various sections of this Project Manual. The Contractor shall coordinate all such submittals, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings, product data, or samples submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for re-submission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such submittals, nor from responsibility for complying with the requirements of this contract, except with respect to variations

described and approved in accordance with Paragraph (d) below.

(h) If shop drawings, product data, or samples show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(i) Upon completing the work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings, product data or samples delivered under this contract.

(j) The provisions of this entire paragraph shall be included in all subcontracts at any tier.

(End of clause)

AOC52.236-12 Product Data and Samples (Jun 2004)

(a) Product data shall mean information (e.g., catalog cuts, standard illustrations, drawings, performance charts, data and brochures) pertinent to a particular product, equipment or material required as a part of the work. Product data is required to establish, for the purposes of evaluation and approval, details of the product offered in response to specifications elsewhere in the contract documents. Product data pertains to significant elements such as (1) design; (2) materials; (3) components; (4) performance characteristics; and (5) methods of manufacture, assembly, construction, or operation. The term includes, in addition to the above, the manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals (if any).

(b) Samples are physical examples of materials, equipment or workmanship that will be used by the Contracting Officer to establish standards by which the work will be judged.

(c) Samples not subject to destructive tests may be retained by the Contracting Officer until completion of the work; they will then be returned to the Contractor, at his own expense, if he so requests in writing.

(End of clause)

AOC52.243-1 Changes - Supplement (Jun 2004)

(a) Definitions.

(1) A change order is a unilateral contract modification, signed by the Contracting Officer, which describes and identifies a particular change in the requirements as permitted by the FAR clause, 52.243-4, Changes and authorizes the contractor to begin performance with the changed requirements. The change order may reference pertinent oral or written directives, provide an adjustment to the contract price and/or time for performance, and direct the contractor to submit a proposal for definitization of the change order.

(2) A supplemental agreement is a bilateral contract modification, signed by the contractor and the Contracting Officer, which either authorizes the contractor to begin performance with the changed requirements in accordance with the equitable adjustment agreed to prior to commencement of performance of the changed requirements or definitizes a change order after agreement of an equitable adjustment to the contract.

(3) Request for Proposal. A request by the Contracting Officer or his duly authorized representative for the contractor to submit a proposal for requirements contemplated to be changed. Such proposal shall be submitted within the time limit specified in the request and in accordance with the requirements and limitations of this clause.

(b) Authorization of changes. All changes to contract requirements will be authorized in writing by the Contracting Officer through one of the following methods:

(1) A Supplemental Agreement, with the concurrence of the contractor; or

(2) A unilateral Change Order.

(c) Submission of proposals and cost breakdowns by the contractor.

(1) Proposals for changes to the contract requirements shall include a brief description of the change; a breakdown of costs as outlined hereinafter; and a time impact analysis (fragnet).

(2) In considering proposals for changes involving added requirements, omitted requirements, or any combination thereof, the Contracting Officer or his duly authorized representative will make check-estimates in such detail as he deems necessary with the view of arriving at equitable adjustments. With each proposal, the contractor shall submit separately an itemized breakdown as per "Exhibit A" hereof, which shall include, but not be limited to, the following:

(i) Direct labor costs;

(ii) Social Security and Unemployment Insurance Taxes;

(iii) Workmen's compensation and general liability insurance;

(iv) Direct material quantities and unit prices (separated into trades);

(v) Construction equipment;

(vi) Overhead; and

(vii) Profit.

(3) If the contractor believes that the change in the contract requirements affects the contract period of performance, as required by AOC52.211-5, Commencement, Prosecution, and Completion of Work, of the Supplementary Conditions, appropriate substantiation must be submitted for evaluation/review.

(4) A complete proposal, including breakdown of cost and time impact, shall be submitted by the contractor within the time frame stipulated in calendar days by the Government for each proposed change. Generally, complete proposals shall be submitted by the contractor within 7 calendar days after the contractor receives the request for proposal, although this time frame may be adjusted for more complex or more urgent requirements. Except as provided by an individual contract modification, no payment for a change order will be made until a supplemental agreement has been signed by the contractor and the Contracting Officer. If complete proposals are not received timely, the Contracting Officer, after consultation with his authorized representative, may determine the cost of the change and the time impact and issue a change order based upon this determination with the stipulation that if a supplemental agreement is not negotiated within a reasonable amount of time, this determination will be final and conclusive, subject only to the contractor's rights of appeal as provided in AOC52.233-1, Disputes, of the General Conditions.

(d) Allowances for overhead and profit.

(1) The following percentages will be allowed for overhead and profit:

(i) The contractor shall receive, as a percentage of the cost of all work performed by his own organization, an amount not to exceed 10% overhead and not to exceed 10% profit; and

(ii) If subcontractor(s) are involved in the change, a fee in an amount not to exceed 10% as a percentage of the total price of the subcontractor portion of the change.

(iii) Subcontractor(s) to the prime contractor (first tier subcontractor(s)) shall receive, as a percentage of the cost of all work performed by or for it, a total amount not to exceed 10% overhead and not to exceed 10% profit.

(iv) The percentages for fees, overhead, and profit permitted by the above shall be allowed only for the contractor and its first tier subcontractors. Percentages for fees, overhead, and profit in any amount will not be allowed for subcontractors of any other tier.

(2) Percentages for overhead allowed are deemed to include, but shall not be limited to, the following:

(i) Field Overhead Items.

(A) Trailer;

(B) Storage Facilities;

(C) Contractor's and subcontractor's superintendence;

(D) Construction equipment/tools, except those that are specially required for a specific change;

(E) Utilities;

(F) Contractor's and subcontractor's field office, administrative/support staff;

(G) Cost of preparing record drawing changes, correspondence, etc., relating to the contract;

(H) Job site safety aids; and

(I) Cleaning and maintenance of nuisance debris from jobsite.

(ii) Office Overhead Items for Contractor and Subcontractors.

(A) Maintenance/operation of principal or branch offices;

(B) Personnel costs;

(C) Cost for preparing correspondence, fragnets, etc., relating to the contract; and

(D) Cost of insurance and bonds, except for insurance costs relating to direct labor, as outlined in "Exhibit A".

(iii) For changes which include custom items unique to the project and which are fabricated off-site, the fabricator, whether the contractor or a subcontractor at any tier, shall furnish a breakdown of costs associated with the work in the fabricating plant. This breakdown shall include labor, material, equipment and overhead/plant costs in sufficient detail to allow for review by the Contracting Officer or his duly authorized representative. Costs charged to overhead/plant shall be allowable costs for the fabricator, whether he is the contractor or a subcontractor at any tier, provided that the costs claimed are consistent with the provisions of Subpart 31.203 of the Federal Acquisition Regulation (Chapter 1, Title 48, Code of Federal Regulations). An amount not to exceed 10% of the cost of the fabricated item will be allowed for the fabricator's profit. If the fabricator is a subcontractor, the overhead and profit percentages for the contractor and any subcontractor at a higher tier having a contractual relationship with the fabricator shall be allowed in accordance with this clause.

(e) Changes involving decreases in price. For changes involving only a decrease in price, the contractor and subcontractors shall return as credit for overhead and profit those same percentages which are allowed for like changes involving increases in price. On changes involving both an increase and a decrease in price, overhead and profit will be allowed only on the net increase.

(f) Changes involving increases or decreases on basis of contract specified unit prices. No percentages for overhead and profit will be

added to, or deleted from, any unit prices in event of an increase or decrease in the contract requirements on the basis of contractual unit prices.

EXHIBIT A

TYPICAL FORM OF BREAKDOWN FOR PRICE ADJUSTMENT

SUBCONTRACTORS' BREAKDOWN

Items Involved	Quantities	Unit Cost	Equipment	Material	Labor	Totals	Final Totals	Unit Cost
[SUBCONTRACTORS BREAKDOWN list]Excavation (Identify)								
* Volume								
* Crane Operator								
* Laborers								
Shoring (Identify)								
* Area								
* Welder								
Subcontractor Total								

PRIME CONTRACTOR'S BREAKDOWN

Items Involved	Quantities	Unit Cost	Equipment	Material	Labor	Totals	Final Totals	Unit Cost
[PRIME BREAKDOWN list]West Wall (Cinder Block)								
* Area								
* Block 8x8x16								
* Mortar								
* Mason								
* Laborer								
Subtotal								
Prime Contractor's Total								
Prime Contractor's Overhead and Profit on Subcontractor								
Total								

(End of Clause)

AOC52.244-1 Award of Subcontracts and Other Contracts for Portions of the Work (Sep 2005)

(a) The Contractor is responsible for coordination of all work performed by its own workforce and those of its subcontractors. Each subcontractor shall be experienced in and capable of performing in a satisfactory manner all work in his speciality, and shall meet the standard of competence established for the Contractor.

(b) The Contractor shall be responsible for all acts of subcontractors employed by him under this contract, and for their compliance with all terms and provisions of the contract applicable to their performance. The Contractor shall continuously coordinate the work of all sub-contractors to assure proper processing and progress of the Work. The Contractor shall require each subcontractor to (1) examine the project schedule, shop drawings and the work of other trades and all sections of the specifications to the extent necessary for satisfactory Installation of his work, and connection between his work and the work of other trades; (2) coordinate his work accordingly; and (3) cooperate with other trades toward timely and satisfactory completion of the entire work.

(c) Organization of the specifications into sections and subsections and the arrangement of drawings shall not control the Contractor in

dividing work among subcontractors or in establishing the extent of work to be performed by any trade.

(d) The Government reserves the right to require dismissal of any subcontractor who, by reason of previous unsatisfactory work on AOC projects or for any other reason, is considered by the Contracting Officer to be incompetent or otherwise objectionable for performing work under this contract.

(e) Nothing contained in the contract documents shall create any contractual relations between any subcontractor and the Government.

(End of clause)

AOC52.246-1 Final Inspection and Acceptance - Construction - Supplement (Mar 2007)

(a) No inspection or other action of the Government shall be construed to constitute a final acceptance of any portion of the work under this contract until all work under the contract is completed. None of the work under the contract shall be deemed to be finally accepted until the Contractor, upon completion and final inspection of all work, is notified in writing of final acceptance of work under the contract, or in lieu thereof, until final payment of the final voucher as prescribed in AOC52.232-4, Payments - Construction. The provisions of FAR clause 52.246-12, Inspection of Construction are hereby modified by the provisions of this paragraph with respect to the finality of acceptance of any portion of the work by the Government prior to completion of all work under the contract.

(b) The Contractor shall notify the Contracting Officer, at least 10 days in advance, of the date the work will be fully complete and ready for final inspection. Any additional costs incurred by the Government due to necessary reinspection of work found not ready for final inspection upon the Contractor's notice of completion will be charged to the Contractor and deducted from the contract price.

(End of clause)

AOC52.246-6 Additional Warranty Coverage (Jun 2004)

If the Contractor receives from any manufacturer, supplier or subcontractor additional warranty coverage on the whole or any component of the work required by this contract, in the form of time including any pro rata arrangements, or the Contractor generally extends to his commercial customers a greater or extended warranty coverage, the Government shall receive corresponding warranty benefits.

(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 60 calendar days. 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)

Clauses By Reference

Clause	Title
52.203-3	Gratuities (Apr 1984)
52.203-5	Covenant Against Contingent Fees (Apr 1984)
52.203-6	Restrictions On Subcontractor Sales To The Government (Sept 2006)
52.215-2	Audit and Records--Negotiation (June 1999)
52.222-4	Contract Work Hours and Safety Standards Act - Overtime Compensation (July 2005)
52.222-6	Davis Bacon Act (July 2005)
52.222-7	Withholding of Funds (Feb 1988)
52.222-8	Payrolls and Basic Records (Feb 1988)
52.222-9	Apprentices and Trainees (July 2005)

Clause	Title
52.222-10	Compliance with Copeland Act Requirements (Feb 1988)
52.222-11	Subcontracts (Labor Standards) (July 2005)
52.222-12	Contract Termination-Debarment (Feb 1988)
52.222-13	Compliance with Davis-Bacon and Related Act Regulations (Feb 1988)
52.222-14	Disputes Concerning Labor Standards (Feb 1988)
52.222-15	Certification of Eligibility (Feb 1988)
52.222-26	Equal Opportunity (Mar 2007)
52.222-27	Affirmative Action Compliance Requirements for Construction (Feb 1999)
52.222-35	Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era and Other Eligible Veterans (Sept 2006)
52.222-36	Affirmative Action for Workers with Disabilities (June 1998)
52.222-37	Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (Sept 2006)
52.223-2	52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts (Dec 2007)
52.223-6	Drug Free Workplace (May 2001)
52.227-1	Authorization and Consent (Dec 2007)
52.228-2	Additional Bond Security (Oct 1997)
52.228-12	Prospective Subcontractor Requests for Bonds (Oct 1995)
52.228-14	Irrevocable Letter of Credit (Dec 1999)
52.229-3	Federal, State and Local Taxes (Apr 2003)
52.232-23	Assignment Of Claims (Jan 1986)
52.236-2	Differing Site Conditions (Apr 1984)
52.236-3	Site Investigation and Conditions Affecting the Work (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)
52.236-11	Use and Possession Prior to Completion (Apr 1984)
52.236-13	Accident Prevention (Nov 1991)
52.236-26	Preconstruction Conference (Feb 1995)
52.242-13	Bankruptcy (July 1995)
52.243-4	Changes (June 2007)
52.246-21	Warranty of Construction (Mar 1994)

Clause	Title
52.249-2	Termination for Convenience of the Government (Fixed-Price) (May 2004)
52.249-10	Default (Fixed-Price Construction) (Apr 1984)
52.246-12	Inspection of Construction (Aug 1996)

Supplementary Conditions

AOC52.201-1 Contracting Officers Authority (Jun 2004)

The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this contract, notwithstanding any provision contained elsewhere in this contract. In the event that the Contractor makes any change at the direction of any person other than the Contracting Officer, the change will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

(End of clause)

AOC52.201-2 Contracting Officers Technical Representative (COTR) (Mar 2005)

The Government shall provide the name, address and telephone number of the COTR at the time of contract award and the duties thereby delegated to that person. Any subsequent change to the individual or the individual s responsibilities will be confirmed in writing by the Contracting Officer. In no instance will the COTR be delegated authority to order any change in the contractor s performance which would affect (a) cost or schedule for contracts for services or supplies, or (b) scope, the completion date for intermediate phases or milestones, or overall completion date for contracts for construction.

(End of clause)

AOC52.204-6 Capitol Complex Conditions Affecting Contractor Operations (May 2008)

Capitol Complex operations are, at irregular and unanticipated times, interrupted due to events that can occur on the Capitol Complex, e.g., funerals that utilize the Rotunda, closure of Congressional buildings due to unusual activities, etc. These events can impact AOC contractor operations. Any AOC contractor that becomes aware of an event that may affect its operations on the Capitol Complex may go to www.aoc.gov/business/contractors to receive current information of the operational status of the Capitol Complex. Before ceasing or limiting its operations, the Contractor must obtain written approval from the Contracting Officer.

(End of clause)

AOC52.211-5 Commencement, Prosecution and Completion of Work (Mar 2007)

(a) All work to be performed under this contract shall be completed within **SEE SUPPLEMENTARY INFORMATION** calendar days after the date of contract award. No work under this contract shall be performed on Saturdays, Sundays or Federal holidays and, for work performed in the District of Columbia, Presidential Inauguration Day, except with prior approval of the Contracting Officer.

(b) Time for completion of the contract work will be adjusted only in accordance with applicable clauses, e.g., Differing Site Conditions, Changes, Changes - Supplement , Suspension of Work, or other clauses, as appropriate.

(End of clause)

AOC52.223-5 Special Security Requirements - Services (MAR 2007)

(a) All vehicles, and contents, used by the Contractor or his subcontractors, which enter or leave United States Government property during performance of the work, will be subject to clearance, inspection and identification procedures conducted by the United States Capitol Police.

(b) All persons entering the Legislative Branch Buildings shall gain access to the building by passing through x-ray screening devices. In addition, all handbags and all hand-carried items shall be screened by x-ray devices prior to their entry into the building.

(c) All personnel provided by the Contractor and employed on the site of the work will be subject to a security background investigation. Each employee will be required to fill out an I.D. Request Form and U.S. Capitol Police Request for check of Criminal History Records and each employee will be photographed and fingerprinted. The Contractor shall provide any assistance required by any of its employees in completing the forms.

(d) Prior to commencement of work, the contractor and all designated on-site employees will be required, on a one-time basis, to be fingerprinted in Washington D.C. The location for the Electronic Fingerprinting Service is the U.S. Capitol Hill Police, Fairchild Building, 499 South Capitol Street SW, Washington, DC 20003.

(e) Within seven (7) calendar days after the date of contract award, the Contractor shall submit to the Contracting Officer's Technical Representative (COTR) a list of all employees proposed to be employed on this contract. This list shall include the employee's full name, date of birth and social security number.

(f) While security background investigations are in process, the Contractor's employees must not be granted access to the Capitol Hill complex to perform work or provide services for the AOC unless they are escorted by an AOC staff member. "Escorted" is defined to mean that the AOC staff member will remain with the employee(s) at all times during the performance of the work. Any of the Contractor's employees who are perceived by the Contracting Officer as a security risk as a result of evidence discovered in the background security investigation will not be issued an Identification Card, will be denied access to the site of the work, and the Contractor will be directed to remove such employee from performance of any of the contract work, whether it be on or off the work site. Any contractor employee denied access to the site of work on a contract or task/delivery order as a result of a security investigation may not apply for access to any other AOC/U.S. Supreme Court contract or task/delivery order work site.

(g) An identification card, with photograph, will be prepared for each employee of the Contractor requiring access to the site. The identification card shall be dated to indicate the period of time for which it is to remain valid - from the date the employee reports for duty until the applicable date which occurs first: the expiration of the contract, or the last date of the employee's tour of duty with the Contractor. All contractor personnel must wear the ID badge whenever on the Capitol complex premises or when attending off-site functions on behalf of the AOC. ID badges must be worn in such a manner that contractor personnel can be easily identified as such.

(h) The Contractor is fully responsible to return:

(1) The ID badge of any individual employee, including subcontractor personnel, who is removed for any reason including but not limited to illness, or dismissal;

(2) The ID badges of all contractor employees, including subcontractor personnel, whose performance under the contract is completed in advance of final contract job completion; and

(3) All outstanding ID badges issued for the contractor and its employees, including subcontractor personnel, within 24 hours of on site contract job completion.

(i) ID badges are to be hand delivered by the contractor within 24 hours of any of the events listed under (f) above to the Contracting Officer's Representative.

(j) The Contractor's failure to return any ID badge, access card, or key issued under this contract or order shall result in a deduction of $100.00 from the contract per ID badge, access card, and/or key not returned.

(End of clause)

AOC52.223-8 Delivery Vehicle Inspection Requirements (Apr 2008)

(a) All vehicles and contents used by the Contractor or his subcontractors which enter or leave United States Government property during performance of work under this contract will be subject to clearance, inspection, and identification procedures conducted by the United States Capitol Police.

(b) All delivery vehicles carrying fuel, garbage, or similar cargo that cannot be offloaded for inspection and security screening shall utilize the alternative Delivery Access Point located at Third and Maryland Avenue, SW, Washington, DC, for inspection prior to making deliveries to any building within the Capitol Complex, including, but not limited to, the U.S. Capitol Building; the U.S. Botanic Garden; the Hart, Dirksen, and Russell Senate Office Buildings; the Rayburn, Longworth, Cannon, and Ford House Office Buildings; the Thomas Jefferson, John Adams, and James Madison Memorial Library of Congress buildings; the Capitol Power Plant; the Capitol Visitors Center; and the U.S. Supreme Court and Thurgood Marshall Federal Judiciary Buildings.

(c) 4700 Shepherd Parkway SW inspection facility. All other vehicles making deliveries to the above listed locations except for the U. S. Supreme Court shall utilize the off-site inspection and screening facilites at 4700 Shepherd Parkway SW, Washington, DC 20032.

(d) For all deliveries within seven calendar days or prior to the first delivery, the contractor shall provide the following information to the U.S. Capitol Police:

(1) List of drivers;

(2) Date of birth for each driver;

(3) Social Security Number of each driver;

(4) Vehicle make;

(5) Vehicle model;

(6) License tag number and state where vehicle is licensed;

(7) Color of vehicle; and

(8) Contractor name, if shown on the vehicle.

(e) Information for deliveries made through the Shepherd Parkway facility must be faxed to (202) 226-0571. For verification of receipt, the contractor may call (202) 226-0905. Updates to the information must be renewed April 30, August 31, and December 31 of each year and provided to the U.S. Capitol Police whenever repetitive deliveries are anticipated.

(f) Any delivery that does not fall into the before mentioned categories should be coordinated, in advance, with the applicable government point of contact.

(End of clause)

AOC52.236-11 Submittals (Jun 2004)

(a) The Contractor shall deliver all required submittals within the times specified elsewhere in this contract. Unless specifically stated otherwise, four (4) sets of each item shall be delivered by the contractor to the Contracting Officer s Technical Representative. An in-depth description of these submittals can be found in the appropriate technical sections of the specification. Any Schedule of Work prepared shall reflect delivery of these items. Failure to provide timely delivery of these submittals may be considered to be grounds for termination for default.

(b) The Government will review the submittals and either approve them as submitted, or mark required changes on them. If change are required, the Contractor shall deliver revised submittals for approval by the Government which incorporate all of the required changes within two weeks after receipt by the Contractor of the marked-up submittals.

(End of clause)

AOC52.242-2 Contractor Performance Evaluations (Dec 2006)

At the conclusion of contract performance and/or at any point during the performance of this contract, the AOC may elect to evaluate the Contractor and submit a final or interim performance evaluation into the appropriate on-line database designated as the repository of Contractor evaluations for the Federal Government. Any evaluation submitted shall include input from the Contracting Officer's Technical Representative and other agency personnel, as appropriate, and the Contracting Officer. The Contractor shall have the opportunity to review any evaluations and submit supporting information for any differing of positions between the Contractor and the AOC in accordance with the protocol established by the specific on-line database.

(End of clause)

Representations and Certifications

52.203-2 Certificate Of Independent Price Determination (Apr 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to--

(i) Those prices;

(ii) The intention to submit an offer; or

(iii) The methods or factors used to calculate the prices offered.

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this provision; or

(2)(i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this provision [insert full name of person(s) in the offeror s organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror s organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) of this provision have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this provision; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies paragraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

52.204-3 Taxpayer Identification (Oct 1998)

(a) *Definitions.*

"Common parent," as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)," as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) *Taxpayer Identification Number (TIN).*

__TIN: _____.

__TIN has been applied for.

__TIN is not required because:

__Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

__Offeror is an agency or instrumentality of a foreign government;

__Offeror is an agency or instrumentality of the Federal Government.

(e) *Type of organization.*

__Sole proprietorship;

__Partnership;

__Corporate entity (not tax-exempt);

__Corporate entity (tax-exempt);

__Government entity (Federal, State, or local);

__Foreign government;

__International organization per 26 CFR 1.6049-4;

__Other _____.

(f) *Common parent.*

__Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

__Name and TIN of common parent:

Name _____.

TIN _____.

(End of provision)

52.209-5 Certification Regarding Responsibility Matters (May 2008)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are __ are not __ presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have __ have not __, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating Federal criminal tax laws, or receiving stolen property;

(C) Are __ are not __ presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision;

(D) Have __, have not __, within a three-year period preceding this offer, been notified of any delinquent Federal taxes in an amount that exceeds $3,000 for which the liability remains unsatisfied.

(1) Federal taxes are considered delinquent if both of the following criteria apply:

(i) The tax liability is finally determined. The liability is finally determined if it has been assessed. A liability is not finally determined if there is a pending administrative or judicial challenge. In the case of a judicial challenge to the liability, the liability is not finally determined until all judicial appeal rights have been exhausted.

(ii) The taxpayer is delinquent in making payment. A taxpayer is delinquent if the taxpayer has failed to pay the tax liability when full payment was due and required. A taxpayer is not delinquent in cases where enforced collection action is precluded.

(2) Examples.

(i) The taxpayer has received a statutory notice of deficiency, under I.R.C. § 6212, which entitles the taxpayer to seek Tax Court review of a proposed tax deficiency. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek Tax Court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(ii) The IRS has filed a notice of Federal tax lien with respect to an assessed tax liability, and the taxpayer has been issued a notice under I.R.C. § 6320 entitling the taxpayer to request a hearing with the IRS Office of Appeals contesting the lien filing, and to further appeal to the Tax Court if the IRS determines to sustain the lien filing. In the course of the hearing, the taxpayer is entitled to contest the underlying tax liability because the taxpayer has had no prior opportunity to contest the liability. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek tax court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(iii) The taxpayer has entered into an installment agreement pursuant to I.R.C. § 6159. The taxpayer is making timely payments and is in full compliance with the agreement terms. The taxpayer is not delinquent because the taxpayer is not currently required to make full payment.

(iv) The taxpayer has filed for bankruptcy protection. The taxpayer is not delinquent because enforced collection action is stayed under 11 U.S.C. 362 (the Bankruptcy Code).

(ii) The Offeror has __ has not __, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (*e.g.*, general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) 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 rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.223-1 52.223-1 Biobased Product Certification (Dec 2007).

Biobased Product Certification (Dec 2007)

As required by the Farm Security and Rural Investment Act of 2002 and the Energy Policy Act of 2005 (7 U.S.C. 8102(c)(3)), the offeror certifies, by signing this offer, that biobased products (within categories of products listed by the United States Department of Agriculture in 7 CFR part 2902, subpart B) to be used or delivered in the performance of the contract, other than biobased products that are not purchased by the offeror as a direct result of this contract, will comply with the applicable specifications or other contractual requirements.

(End of provision)

AOC52.204-2 Data Universal Numbering System (Duns) Number (Jun 2004)

(a) The offeror shall enter, in the space provided below, the DUNS number that identifies the offeror s name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contract Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(1) Company name,

(2) Company address;

(3) Company telephone number;

(4) Line of business;

(5) Chief executive officer/key manager;

(6) Date the company was started;

(7) Number of people employed by the company; and

(8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet home page at http://www.customerservice@dnb.com. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

(d) Enter DUNS number:_____.

(End of provision)

AOC52.204-3 Representations and Certifications (Nov 2004)

The offeror shall properly execute and submit with its offer the Representations and Certifications contained herein. Insert information in spaces provided as applicable.

(End of provision)

AOC52.215-8 Authorized Negotiators (Jun 2004)

The offeror represents that following persons are authorized to negotiate on its behalf with the Government in connection with this Request for Proposal:

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

Name: _____ Title: _____

Telephone: _____ E-Mail: _____

(End of provision)

AOC52.219-2 AOC52.219-2 Small Business Representations and Certifications (Nov 2007)

(a) If this procurement exceeds $100,000 the North American Industry Classification System (NAICS) code for this procurement is 238220 and the small business size standard is _____ (if this requirement is for manufacturing or trade) or $ 13,000,000.00 (if this requirement is for services, including construction).

(b) The Architect of the Capitol maintains information on the types of contractors to whom contract and order awards are made in order to monitor the success of our efforts to improve contracting opportunities in the small business community. Therefore, each offeror shall complete the information regarding the classification of its type of entity.

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

"Small business" means a business concern that is organized for profit, has a place of business in the United States, and does not exceed the size standard for its industry. It may be a sole proprietorship, partnership, corporation, or any other legal entity.

"Service-disabled veteran-owned small business concern" means a small business concern (1) not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and (2) the management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

"Veteran-owned small business concern" means a small business concern (1) not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and (2) the management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern" means a small business concern (1) that is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and (2) whose management and daily business operations are controlled by one or more women.

"Large business concern" is an entity that is organized for profit, has a place of business in the United States, and exceeds the size standard for its industry.

"Nonprofit organization" is an entity that is not organized for profit, e.g., the American Red Cross, universities, and foundations.

"Foreign contractor" is an entity organized for profit that is not in the United States.

(d) Small disadvantaged business, women-owned small business, veteran-owned small business, service-disabled veteran-owned small business, and HUBZone small business concerns are subcategories of small business. Small disadvanted business and HUBZone small business concerns require certification by the U.S. Small Business Administration. Additional information is available at http://www.sba.gov.

(e) For entities organized for profit, the size standards for each industry can be found at http://www.sba.gov/gopher/Government-Contracting/Size/. A business is large if the number of employees or revenue amount exceeds that shown in the applicable industry.

(f) Indicate below the information that best describes your organization and check all categories that apply. For example, if your organization is women-owned and veteran-owned small business, then check "Small Business", Women-owned small business", and "Veteran-owned small business".

_____ Nonprofit organization (do not check any other box).

_____ Large business (do not check any other box).

_____ Foreign contractor (do not check any other box).

_____ State/local/Federal government agency (do not check any other box).

_____ Small business (see 13 CFR Part 121).

_____ HUBZone small business (see 13 CFR Part 126).

_____ Small disadvantaged business (see 13 CFR 124.1002).

_____ Service-disabled veteran-owned small business (see 38 U.S.C. 101(2) and 38 U.S.C. 101(16)).

_____ Veteran-owned small business (see 38 U.S.C. 101(2)).

_____ Women-owned small business.

(End of provision).

Solicitation Conditions

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

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):

www.gsa.gov or www.arnet.gov

(End of provision)

52.211-6 Brand Name or Equal (Aug 1999)

(a) If an item in this solicitation is identified as "brand name or equal," the purchase description reflects the characteristics and level of quality that will satisfy the Government's needs. The salient physical, functional, or performance characteristics that " equal" products must meet are specified in the solicitation.

(b) To be considered for award, offers of "equal" products, including "equal" products of the brand name manufacturer, must-

(1) Meet the salient physical, functional, or performance characteristic specified in this solicitation;

(2) Clearly identify the item by-

(i) Brand name, if any; and

(ii) Make or model number;

(3) Include descriptive literature such as illustrations, drawings, or a clear reference to previously furnished descriptive data or information available to the Contracting Officer; and

(4) Clearly describe any modifications the offeror plans to make in a product to make it conform to the solicitation requirements. Mark any descriptive material to clearly show the modifications.

(c) The Contracting Officer will evaluate "equal" products on the basis of information furnished by the offeror or identified in the offer and reasonably available to the Contracting Officer. The Contracting Officer is not responsible for locating or obtaining any information not identified in the offer.

(d) Unless the offeror clearly indicates in its offer that the product being offered is an "equal" product, the offeror shall provide the brand name product referenced in the solicitation.

(End of provision)

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)

AOC52.204-5 AOC52.204-5 Registration In The Central Contractor Registration (CCR) (Nov 2007)

(a) The Architect of the Capitol anticipates that in the future the agency's contractors may have to register in the CCR database. This is the primary vendor database for the Executive Branch of the U.S. Federal Government. CCR collects, validates, stores, and disseminates data in support of agency acquisition missions.

(b) CCR requires vendors to complete a one-time registration to provide basic information relevant to procurement and financial transactions. Vendors must update or renew their registration at least once per year to mainatain an active status. CCR validates the vendor information and electronically shares the secure and encrypted data with the Federal agencies' finance offices to facilitate paperless payments through electronic funds transfer (EFT).

(c) The AOC is now encouraging all vendors to register in the CCR if they have not already done so. Vendors can register on line at http://ccr.gov. This internet site contains all pertinent information for registrration as well as provides contact points for help when registering.

(End of provision)

AOC52.206-1 AOC52.206-1 Procurement Authority for the Architect of the Capitol (Sep 2007)

The authority for all purchase orders and contracts awarded by the Architect of the Capitol is 41 U.S.C. 5, 41 U.S.C. 6a-1, and 41 U.S.C. 6a-2, as amended by Public Laws 107-68, 108-7, and 108-83.

(End of Provision)

AOC52.215-1 Instructions to Offerors (Jul 2007)

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

Proposal modification is a change made to a proposal before the solicitation s closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

Proposal revision is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

Time, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays, including Presidential Inauguration Day. However, if the last day falls on a Saturday, Sunday, or legal holiday, including Presidential Inauguration Day, then the period shall include the next working day.

(b) Offerors are expected to examine the entire solicitation and all instructions. Failure to do so will be at the offeror s risk. Each offeror shall furnish the information required by the solicitation. The offeror will be held responsible for full knowledge of all information contained therein.

(c) Packaging, transmission, and tracking of proposals. (1) Proposals, modifications, and revisions shall be enclosed, in the quantities specified elsewhere in this solicitation, in sealed envelopes. With each copy of the form entitled, "SOLICITATION, OFFER, AND AWARD", the offeror shall enclose the completed Schedule page; offer guarantee, if required; and Representations and Certifications. Address envelopes to: Architect of the Capitol, Procurement Division, Ford House Office Building, Attn: Fred Witcher, Room H2-263 Bid Room, Second and D Streets, S.W., Washington, DC 20515. Offeror shall write Bid Documents Enclosed, H2-263 Bid Room, and write the solicitation number, time and date for receipt of offers on the exterior of the package on the same side as the address. Telegraphic or facsimile proposals and modifications will not be considered.

(2) Current security requirements established by the U.S. Capitol Police to screen mail being delivered to the U.S. Capitol Complex of buildings preclude the use of U. S. Postal Service by offerors to deliver their proposals submitted in response to this solicitation. In addition, because all packages must be screened for security purposes at a central location prior to their delivery, the Architect of the Capitol cannot accept packages containing offers hand carried directly to the Bid Room address within the Ford House Office Building, or any other location in the U.S. Capitol Complex of buildings. See Notice for Delivery on the front of the solicitation.

(3) To assist in tracking of proposals, offerors are requested to fax a copy of their signed Solicitation, Offer and Award form as well as a copy of the FEDEX or UPS receipt to Fred Witcher to (866) 539-4925 at the time of the issuance of their proposal.

(4) The only acceptable method by which offerors can deliver their responses to this solicitation shall be via Federal Express (FEDEX) or United Parcel Service (UPS). Offers submitted via any other method will be rejected. OFFERORS - DO NOT MAIL YOUR OFFER BY REGULAR U.S. MAIL. See notice attached to this solicitation for special instructions.

(d) Submission, modification, revision, and withdrawal of proposals. (1) Offerors are responsible for submitting proposals and any modifications or revisions so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m. local time, for the designated Government office on the date that the proposal or revision is due.

(2) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is late and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would no unduly delay the acquisition, and-

(i) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals;

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of proposals and was under the Government s control prior to the time set for receipt of proposals; or

(iii) It is the only proposal received.

(3) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(4) Acceptable evidence to establish the date of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(5) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of proposals by the exact time specified in the solicitation and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(6) Proposals may be withdrawn by written notice received at any time before award. Proposals may be withdrawn in person by an

offeror or an authorized representative if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(End of provision)

AOC52.215-2 Interpretations and Amendments (Jun 2004)

(a) Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing no later than fourteen calendar days prior to the date established for receipt of offers. Oral explanations or instructions given before the award of a contract will not be binding.

(b) Prospective offerors shall request the Contracting Officer, in writing, via FAX or e-mail for an interpretation or correction of any ambiguity, inconsistency, or error in the contract documents which they may discover or which should have been discovered by a reasonably prudent offeror. Such requests or objections to materials or methods of construction shown or specified shall be directed to the attention of the Contracting Officer at least fifteen (15) calendar days prior to the date specified for receipt of proposals. Written requests shall be transmitted via e-mail to fwitcher@aoc.gov or via facsimile to (866) 539-4925.

(c) Any interpretations or corrections, as well as any additional modifications the Contracting Officer may desire to include, will be in the form of amendments, in writing, which will be sent on the same date to all offerors if that information is necessary in submitting offers or if the lack of it would be prejudicial to other prospective offerors and shall become a part of any subsequent contract. The Contracting Officer reserves the right to answer only such questions as have, in his opinion, a definite bearing upon the proposals to be submitted.

(1) Offerors shall acknowledge the receipt of all amendments to the solicitation by:

(i) Signing and returning the amendment;

(ii) Identifying the amendment number and date in the space provided for this purpose on the form for submitting a offer;

(iii) Letter or telegram; or

(iv) Facsimile, if facsimile offers are authorized in the solicitation.

(2) The Government must receive the acknowledgment by the time and at the place specified for receipt of offers.

(d) Requests for oral interpretations or any other interpretations not made by amendments will not be accepted, and any information that may possibly be gained by offerors in that manner is gratuitous and not binding.

(e) If this solicitation is amended, all terms and conditions that are not amended remain unchanged.

(End of provision)

AOC52.215-3 Restriction on Disclosure and Use of Data (Jun 2004)

Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall

(a) Mark the title page with the following legend:

This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with--the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government s right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets (insert numbers or other identification of sheets) ; and

(b) Mark each sheet of data it wishes to restrict with the following legend:

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(End of provision)

AOC52.215-7 Preparation of Proposals - Construction (Jun 2004)

(a) Offers shall be submitted, in the quantities as stated elsewhere in this solicitation, on the accompanying printed form entitled, SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair) and copies thereof, with blank spaces suitably filled in. Erasures or other changes on any or all submissions shall be initialed by the signer of the offer.

(b) Copies of the offer shall be identical and each copy shall give the full business address of the offeror, and be signed by him (see Block 20B of the form entitled, SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair) with his usual signature. Offer by partnerships shall furnish the full names of all partners, and shall be signed with the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing. Offers by corporations shall be signed with the legal name of the corporation, followed by the name of the State of incorporation and by the signature and designation of the president, secretary, or other person authorized to bind it in the matter. The name of each person signing shall be typed or printed below the signature. An offer by a person who affixes to his signature the

word president , Secretary , agent , or other designation, without disclosing his principal, may be held to be the offer of the individual signing. When requested by the Government, satisfactory evidence of the authority of the offer signing in behalf of the corporation shall be furnished.

(End of provision)

AOC52.215-9 Failure to Submit Offer (Jun 2004)

Recipients of this solicitation not responding with a proposal should not return this solicitation, unless it specifies otherwise. Instead, they should advise the issuing office by letter, postcard, or established electronic commerce methods, whether they want to receive future solicitations for similar requirements. If a recipient does not submit a proposal and does not notify the issuing office that future solicitations are desired, the recipient s name will be removed from the applicable mailing list.

(End of provision)

AOC52.228-7 Offer Guarantee - Construction (Dec 2006)

(a) An offer guarantee is required for all offers exceeding $100,000. For a new definitive contract (one containing no provisions for issuance of task orders) or purchase order, the amount of the offer guarantee is based upon the proposed amount of the offer. For a requirements contract, the offer guarantee is based upon the price payable for the estimated total quantity. For an indefinite-quantity contract, the offer guarantee is based upon the price payable for the specified minimum quantity. The price of any options is not included except for those options exercised at the time of the contract award.

(b) Failure to furnish an Offer Guarantee in the required form and amount, with and as a part of the proposal, will be cause for rejection of the proposal.

(c) The offeror shall furnish an Offer Guarantee of not less than 20% of the proposed price in the form of a firm commitment consisting of a Bid Bond, Certified Check, Cashier's Check, Irrevocable Letter of Credit, or Postal Money Order made payable to the Architect of the Capitol, or under Treasury Department Regulations certain bonds or notes of the Unites States. The Contracting Officer will return Offer Guarantees, other than Bid Bonds, (1) to unsuccessful offerors as soon as practicable after evaluation of the proposals; and (2) to the successful offeror upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the offer as accepted.

(End of provision)

AOC52.236-13 Visit to the Site of the Work - Construction (Jun 2004)

(a) It is strongly recommended that all prospective offerors visit the site where the work is to be performed, compare the work requirements with existing conditions, verify dimensions, if necessary, and fully inform themselves regarding the nature and scope of the proposed work and the conditions under which it will be conducted. Offerors shall also inform themselves regarding other work, if any, being done or to be done by or for the United States government, the District of Columbia government and utility companies, by contract or otherwise, where such work may affect or be affected by the operations under the contract. Failure to take these precautions will in no way relieve the successful offeror from his obligation to furnish all materials, services, labor, and any other requirements necessary to complete the work satisfactorily under the conditions established by the contract documents and without additional expense to the Government.

(b) A pre-proposal meeting will be conducted at the TBD Washington, D.C. for all prospective offerors on

TBD at TBD, local time.

(c) The Architect will conduct one field inspection of the work immediately following the pre-proposal meeting. Those intending to participate shall meet at the address above. Information concerning the meeting may be obtained by telephoning Mike Shirven

at (202) 224-4828.

(d) Offerors are encouraged to submit all questions in writing at least five (5) working days prior to the conference. Questions will be considered at any time prior to or during the conference; however, offerors will be asked to confirm verbal questions in writing. Subsequent to the conference, an amendment to the solicitation containing an abstract of the questions and answers, and a list of attendees, will be disseminated.

(e) Offerors are cautioned that, notwithstanding any remarks or clarifications given at any site visit, the pre-proposal conference or field inspection, all terms and conditions of the solicitation remain unchanged unless they are changed by amendment to the solicitation. If the answers to conference questions, or any solicitation amendment, create ambiguities, it is the responsibility of the offeror to seek clarification prior to submitting an offer.

(End of provision)

L1 PROPOSAL COMPOSITION - SOURCE SELECTION PROCEDURES

(a) Proposals shall be submitted in two major subdivisions: Technical Proposal whose content and arrangement shall be as described in the article entitled, INSTRUCTIONS FOR PREPARING THE TECHNICAL PROPOSAL - SOURCE SELECTION PROCEDURES of this section and a Price Proposal, which shall be prepared in detail on a basis as described and set forth in the article entitled, INSTRUCTIONS FOR PREPARING THE PRICE PROPOSAL - SOURCE SELECTION PROCEDURES of this section.

(b) The Technical Proposal and the Price Proposal portions of each proposal tendered by any offeror shall each be enclosed in a separate sealed package, identified on its outer surface as to content in the manner prescribed in the article entitled SUBMISSION, MODIFICATION, REVISION, AND WITHDRAWAL OF PROPOSALS of this section and submitted in the following number of copies:

(1) Technical Proposal - One (1) original and three (3) copies

(2) Price Proposal - One (1) original and one (1) copy

(c) Each offeror may submit one or more proposals; however, each proposal shall be configured as described above, shall be considered on its own merits as to the completeness of submission and shall not share required documentation, bonding, or other requirements of submission with any other proposal submitted by the same offeror.

L2 INSTRUCTIONS FOR PREPARING THE TECHNICAL PROPOSAL

a) The Technical Proposal shall be organized in accordance with the following format to facilitate evaluation by the Architect of the Capitol.

The Technical Proposal shall be subdivided into three (3) subsections each with its own tab identifying the factor (and tabs identifying the subfactors, where applicable) and shall be on 8-1/2 x 11 sheets in a 3-Ring binder.

(b) The Offeror shall provide a description of each factor as noted below:

1. Evaluation Factor 1 - Corporate Experience

The offeror shall provide a narrative describing the qualifications and experience of the offeror and any proposed subcontractors in performing similar projects (at least 2 projects) in size, scope and complexity (e.g., demolition/new construction of large air handling units on site, HVAC support systems including DDC controls, etc) and which involved tasks similar to those described in the specifications completed by the firm during the last five (5) years. For each project listed, provide the following:

a. From/To (Dates- Month/Year):
b. Project Description (Identify the project):
c. Client Agency:
d. Technical Point of Contact:
e. Current Phone Number for Point of Contact:
f. Dollar Value of Contract:
g. Relevance of Experience to This Project:

2. Evaluation Factor 2 - Key Personnel

Key Personnel (Project Manager and Superintendent) - The offeror shall provide a resume for each key personnel position. Each resume should document recent and relevant experience (within the past five years) for similar projects in scope, size and complexity and which involved similar tasks, performed by the individual during the last five years, shall be a maximum of four pages, including beginning and ending month and year for each job, and include the following information:

a. A list of projects and the level of involvement.

b. List relevant education, training and skills.

c. A list of at least five (5) references who can provide appropriate feedback about the quality of performance and technical capabilities. Include a contact name, company name and address, and current telephone number.

d. Position and number of years with the Offeror.

3. Evaluation Factor 3 - Corporate Past Performance Although the Government reserves the right to use any source of information available on the Offeror's past performance to either evaluate past performance or verify information provided by the Offeror, the Offeror shall provide information that demonstrates the offeror's past performance. The enclosed "AOC PAST PERFORMANCE QUESTIONNAIRE" shall be provided to each of the companies/agencies submitted by the offeror in response to Evaluation Factors 1 and 2. The questionnaire(s) must be faxed by the companies/agencies to the attention of Fred Witcher at (866) 539-4925 by the date established for receipt of offers in order to be considered in the evaluation process. A neutral rating will be applied for those projects/contracts for which a questionnaire is not received.

L3 INSTRUCTIONS FOR PREPARING THE PRICE PROPOSAL - SOURCE SELECTION PROCEDURES

(a) A firm fixed-price shall be entered by each offeror on the Schedule page for each line item (line item pricing, options and unit prices) which shall represent the cost for performing the work required by this Request for Proposal. The Architect reserves the right to request from each offeror information regarding the breakdown of all costs that are included in the lump sum price (**Line Item Nos. 1 through 14, inclusive**), to include copies of all work sheets used in forming the proposed pricing. Erasures or other changes on any or all submissions shall be initialed by the signer of the proposal or by his duly authorized agent.

(b) In addition, the Representations and Certifications, with applicable information included in the spaces provided shall be included as a part of the Price Proposal.

(c) The Price Proposal will be submitted with the required documents in the following order:

(1) The SOLICITATION, OFFER, AND AWARD FORM (original signature required in Block 20b);

(2) The SCHEDULE; pages 3 thru 6; and

(3) The REPRESENTATIONS AND CERTIFICATIONS; pages 33 thru 37.

(d) The offeror shall identify in the proposal any Government Furnished Property (i.e. Information Technology equipment) that will be required during the contract period or if access is required to the AOC network during this period.

(e) **Price Proposal Breakdown**

To aid in proposal evaluation offerors should be prepared to submit detailed pricing information in Construction Specifications Institute (CSI) format upon request.

52.217-5 Evaluation of Options (July 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.225-10 Notice of Buy American Act Requirement--Construction Materials (May 2002)

(a) *Definitions.* "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 Act -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 Act 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 Act 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 Act, 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)

AOC52.215-5 Contract Award - Source Selection Procedures (Jun 2004)

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, cost or price and other factors, specified elsewhere in this solicitation, considered.

(b) The Government may

(1) Reject any or all offers if such action is in the public interest;

(2) Accept other than the lowest offer; and

(3) Waive informalities and minor irregularities in offers received.

(c) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in 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.

(d) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the offer.

(e) A written award or acceptance of offer mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer as provided in Paragraph (d) of this provision), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award. Negotiations conducted after receipt of an offer do not constitute a rejection or counteroffer by the Government.

(f) Neither financial data submitted with an offer, nor representations concerning facilities or financing, will form a part of the resulting contract. However, if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished is incomplete, inaccurate, or not current.

(g) The Government may determine that an offer is unacceptable if the prices proposed are materially unbalanced between line items or sub line items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(End of provision)

M1 PROPOSAL EVALUATION CRITERIA

(a) The evaluation criteria to be used by the Contracting Officer for the selection of a contractor to perform the work specified are defined below. The criteria are divided into technical and price categories which consist of subsections corresponding to those in the article entitled "INSTRUCTIONS FOR PREPARING THE TECHNICAL PROPOSAL" and the article entitled "INSTRUCTIONS FOR PREPARING THE PRICE PROPOSAL" in Section L. The technical criteria are considered by the Architect to be generally more important than price criteria. However, as the difference in technical merit between the proposals becomes less significant, the relative importance of the price will increase.

(b) TECHNICAL CRITERIA. Each offeror's proposal will be evaluated in accordance with the technical criteria listed below to determine whether it is responsive to the requirements of the RFP and are therefore acceptable. Technical criteria are listed below in descending order of importance:

1. **Corporate Experience**. The offeror's and its proposed subcontractor's experience will be evaluated to determine the extent of its experience relevant to this requirement during the last five years. Higher scores will be given to offerors whose experience is most extensive in the custom-fabrication and manufacture of products using the same materials and similar tasks specified for this requirement.

2. **Key Personnel**. The resume of your proposed Project Manager and Superintendent will be evaluated to determine the level of his/her qualifications to perform the duties required by this solicitation. Higher scores will be assigned to those offeror's whose proposed personnel have the most relevant education, training and skills. The resumes will also be evaluated to determine the extent of successful participation in similar projects within the past five years, taking into consideration degree of client satisfaction for each project. Higher scores will be given to offerors whose key personnel's relevant experience is extensive and whose past performance has been highly successful.

3. **Corporate Past Performance**. The offeror's past performance will be evaluated to determine the extent of successful completion of similar projects within the past five years, taking into consideration timeliness and degree of client satisfaction for each project. Higher scores will be given to offerors whose past performance has exhibited the most success on similar projects. In investigating the offeror's past performance, the Government will consider references submitted by the offeror and may consider information from other sources.

(c) PRICE CRITERIA. The Government will evaluate the price proposals of all firms found technically qualified. Price criterion measure not only actual dollars but also analyze the reasonableness of the Offeror's proposed price.

SUPPLEMENTARY INFORMATION

CONTRACT TIME/SUBMITTAL SCHEDULE

(a) All work to be performed under this contract for the **Base Bids** including, but not limited to, the shop drawing submittals, review, fabrication and construction shall be completed in the time periods indicated below. **All time frames are from the date of the issuance of the contract award**. **Firm due dates will be established upon award**.

Schedule of Values	30 calendar days
HVAC Controls Qualifications	30 calendar days
Shop Drawing Submittal Schedule	30 calendar days
Commissioning Entity (if applicable)	45 calendar days
Progress Schedule	60 calendar days
Submittal Log	60 calendar days
Asbestos Abatement Plan	9 weeks
Shop drawings submittal (Temp. AHU)	12 weeks
Shop drawing and submittal review (remainder)	36 weeks
Shop drawings resubmittal and approval	46 weeks
Substantial Completion (**construction complete; punchlist phase begins**)	108 weeks
Closeout Submittals	114 weeks
Final Acceptance	120 weeks

(b) All work to be performed under this contract for the **Options**, including, but not limited to, the shop drawing submittals, review, fabrication and construction shall be completed in the time periods indicated below. **All time frames are from the date of award of the option**. **Firm due dates will be established upon award**.

Schedule of Values	30 calendar days
Shop Drawing Submittal Schedule	30 calendar days
Progress Schedule	60 calendar days
Submittal Log	60 calendar days
Asbestos Abatement Plan	9 weeks
Shop drawing and submittal review	26 weeks
Shop drawings resubmittal and approval	36 weeks
Substantial Completion (**construction complete; punchlist phase begins**)	88 weeks
Closeout Submittals	94 weeks
Final Acceptance	100 weeks

(c) Time for completion of the contract work will be adjusted only in accordance with applicable articles in the GENERAL CONDITIONS (e.g., "Differing Site Conditions", "Changes", "Suspension of Work").

LIQUIDATED DAMAGES

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages ****as shown below**** for each calendar day of delay for all work listed as **BASE BIDS** or **OPTIONS**.

** **South Stack - $2,000.00**
** **Center Stack - $3,105.00**
** **North Stack - $2,200.00**

(c) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the government in completing the work.

(d) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

AOC PAST PERFORMANCE QUESTIONNAIRE
RFP080062

DIRKSEN SENATE OFFICE BUILDING, INFRASTRUCTURE IMPROVEMENTS
PHASE I - TASK 9

The company listed below is preparing an offer on the above project for the Architect of the Capitol, Washington, DC. Your name has been provided as a customer reference regarding performance under a past contract with your agency/company. Your comments are considered Source Selection Sensitive, therefore, you are advised that your response will be safeguarded to the extent cited in the Federal Acquisition Regulation (FAR) 42.1503. FAR prohibits the release of past performance evaluations to other than other Government personnel and the company whose performance is being evaluated during the period the information may be used to provide source selection information.

This past performance questionnaire is being submitted by the contractor and you are requested complete it and return it to the Architect of the Capitol in care of Fred Witcher at FAX number (866)539-4925 on or before the proposal submission due date of **20 Aug 08**. While all elements below may not apply, please complete as much as possible.

Company/Individual Requesting Past Project Information:

Name:_____

Past Project Title On Which The Company Is Being Evaluated

Project Title :_____

Evaluator POC (for verification purposes)

Name: Agency/Company, POC _____Date:_____

Phone No.:_____ Fax No. _____

E-mail Address: _____

Address:_____

Position held or function in relation to project: _____

AOC PAST PERFORMANCE QUESTIONNAIRE
RFP080062

Ratings: Please evaluate the contractor's performance using the following ratings:

"O" Outstanding The contractor's performance clearly exceeded the contract requirements.
"S" Satisfactory The contractor's performance met the contract requirements.
"M" Marginal The contractor's performance met the minimum contract requirements but with difficulty.
"U" Unsatisfactory The contractor's performance was poor and/or did not satisfy contract requirements.

Please rate and provide supporting information for the following. If the rating is Outstanding or Unsatisfactory, please provide specific contract/job performance areas which were exceeded or not performed in accordance with the contract's minimum requirements. (Use additional sheets as needed)

1. Performance in meeting delivery/completion schedules: _____

_____ **Rating:** _____

2. What did the contractor do to improve or resolve schedule problems, if any?_____

_____ **Rating:** _____

3. The contractor's quality control (CQC)._____

_____ **Rating:** _____

4. The contractor's performance in delivering quality work in accordance with the contract:

_____

_____ **Rating:** _____

5. The contractor's ability to provide the required work at a reasonable total price._____

_____ **Rating:** _____

6. The contractor's compliance with labor standards, if applicable._____

_____ **Rating:** _____

AOC PAST PERFORMANCE QUESTIONNAIRE
RFP080062

7. The contractor's compliance with safety standards. _____

_____ **Rating:** _____

8. Has the contractor been given any of the following: Cure notice, show cause, letters of reprimand, suspension of payments, termination? If yes, please explain. _____

_____ **Rating:** _____

9. Would you award another contract to this contractor? If no, please state reasons for not recommending this contractor additional work. _____

_____ **Rating:** _____

10. Was the customer satisfied with the end product? _____

_____ **Rating:** _____

11. The relationship between the contractor and owner's contract team/Contracting Officer/COR/COTR?

_____ **Rating:** _____

12. The contractor's on-site management and coordination of subcontractors.

_____

_____ **Rating:** _____

13. The contractor's overall corporate management, integrity, reasonableness and cooperative conduct.

_____

_____ **Rating:** _____

14. Has the contractor filed any modifications?_____ How many? _____

And to what extent? _____

15. Has the contractor been provided an opportunity to discuss any negative performance ratings?

If so, what were the results? _____

AOC PAST PERFORMANCE QUESTIONNAIRE
RFP080062

16. **OVERALL RATING** **Rating:** _____

17. Please provide any additional comments:_____

_____

_____

_____

_____

_____

_____

General Decision Number: DC080003 07/04/2008 DC3

Superseded General Decision Number: DC20070003

State: District of Columbia

Construction Type: Building

County: District of Columbia Statewide.

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

Modification Number	Publication Date
0	02/08/2008
1	04/18/2008
2	05/02/2008
3	05/09/2008
4	05/30/2008
5	06/06/2008
6	07/04/2008

ASBE0024-001 10/01/2007

	Rates	Fringes
Asbestos Worker/Heat and Frost Insulator Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems	$ 27.88	13.88

ASBE0024-005 10/01/2007

	Rates	Fringes
Fire Stop Technician	$ 22.95	6.39

Includes the application of materials or devices within or around penetrations and openings in all rated wall or floor assemblies, in order to prevent the pasage of fire, smoke of other gases. The application includes all components involved in creating the rated barrier at perimeter slab edges and exterior cavities, the head of gypsum board or concrete walls, joints between rated wall or floor components, sealing of penetrating items and blank openings.

BRDC0001-001 04/30/2007

	Rates	Fringes
Bricklayer	$ 25.90	6.19

CARP0132-006 05/01/2008

	Rates	Fringes
Carpenters (Including Drywall Hanging)	$ 25.37	6.55
Piledriver	$ 23.87	7.10

ELEC0026-003 09/03/2007

	Rates	Fringes
Communication Technician	$ 23.15	3%+6.87

SCOPE OF WORK: Includes low voltage construction, installation, maintenance and removal of teledata facilities (voice, data and video) including outside plant, telephone and data inside wire, interconnect, terminal equipment, central offices, PABX, fiber optic cable and equipment, railroad communications, micro waves, VSAT, bypass, CATV, WAN (Wide area networks), LAN (Local area networks) and ISDN (Integrated systems digital network).

WORK EXCLUDED: The installation of computer systems in industrial applications such as assembly lines, robotics and computer controller manufacturing systems. The installation of conduit and/or raceways shall be installed by Inside Wiremen. On sites where there is no Inside Wireman employed, the Teledata Technician may install raceway or conduit not greater than 10 feet. Fire alarm work is excluded on all new construction sites or wherever the fire alarm system is installed in conduit. All HVAC control work.

ELEC0026-016 06/02/2008

	Rates	Fringes
Electricians (Excluding Communication-Low Voltage Wiring)	$ 35.55	11.42+a

a. PAID HOLIDAYS: New Year's Day, Martin Luther King Jr.'s Birthday, Inauguration Day, Memorial Day, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day or days designated as legal holidays by the Federal Government.

ENGI0077-009 05/01/2008

	Rates	Fringes
Power equipment operators:		
Boom Trucks	$ 27.57	7.17+a
Cranes (35 tons and above)	$ 28.74	7.17+a
Cranes (under 35 tons)	$ 28.28	7.17+a
Forklifts	$ 21.00	7.17+a
Piledrivers	$ 28.28	7.17+a

a. PAID HOLIDAYS:
New Years Day, Inaugural Day, Decoration Day, Independence Day, Labor Day, Martin Luther King's Birthday, Veterans Day, Thanksgiving Day, Friday after Thanksgiving and Christmas Day.

b. PREMIUM PAY:
Tower cranes and cranes 100-ton and over to receive $1.00 per hour premium over Group One.

IRON0005-001 06/01/2007

	Rates	Fringes
Ironworkers:		
Structural, Ornamental and Chain Link Fence	$ 26.73	11.995

IRON0201-003 05/01/2008

	Rates	Fringes
Ironworker (Reinforcing)	$ 26.15	12.08

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* LABO0657-001 06/01/2008

	Rates	Fringes
Laborer:Skilled	$ 19.57	4.68

FOOTNOTE: Potmen, power tool operator, small machine operator, concrete labor including concrete preparation, signalmen, laser beam operator, waterproofer, open caisson, test pit, underpinnig, pier hole and ditches, laggers and all work associated with lagging that is not expressly stated, strippers, operator of hand derricks, vibrator operators, pipe layers, or tile layers (tile laid on road construction projects ONLY), operators of jackhammer, paving breakers, spaders or any machine that does the same general type of work, scaffold builders, operators of towmasters, scootcretes, buggymobiles and other machines of similar character, operators of tampers and rammers and other machines that do the same general type of work, whether powered by air, electric or gasoline builders of trestle scaffolds over one tier high and sand blaster, power and chain saw operators used in clearing, installers of well points, wagon drill operators, acetylene burners and licensed powdermen.

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* LABO0657-002 06/01/2008

	Rates	Fringes
Laborers:		
Mason Tenders, Brick	$ 14.65	4.68
Mortarmen, Scaffold Builders	$ 15.45	4.68

MARB0002-002 05/01/2007

	Rates	Fringes
Marble & Stone Mason	$ 31.00	11.52

INCLUDES pointing, caulking and cleaning of All types of masonry, brick, stone and cement structures; EXCEPT pointing, caulking and cleaning of exisiting masonry, brick, stone and cement (restoration work)

MARB0003-001 05/01/2007

	Rates	Fringes
Mosaic & Terrazzo Worker, Tile Layer		
Marble Mason and Tile Layer	$ 24.67	8.78
Terrazzo Worker	$ 25.42	8.78

MARB0003-004 05/01/2007

	Rates	Fringes
Marble, Tile & Terrazzo Finisher	$ 19.84	7.90

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* PAIN0051-004 06/01/2008

	Rates	Fringes
Glaziers		
Contracts $2 million and under	$ 25.12	7.46
Contracts over $2 million	$ 27.84	7.46

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* PAIN0051-010 06/01/2008

	Rates	Fringes
Painters:		
Brush, Roller, Spray and Drywall Finisher	$ 24.31	7.56

PLAS0891-003 05/01/2007

	Rates	Fringes
Cement Mason/Concrete Finisher	$ 26.15	6.01

PLUM0005-007 10/21/2007

	Rates	Fringes
Plumbers		
Apartment Buildings over 4 stories (except hotels), schools, colleges and		

speculative office
buildings, strip shopping
centers, churches, water
coolers, room air
conditioning units,
appliances, packaged ice
machines and light
commerical refrigeration
and/or air conditioning
systems serving a single
business in a single story
building and not to exceed
5. h.p. or tons, self-
contained package unit up
to including 5 h.p. or tons.$ 21.54 8.33+a
ALL Other Work.....$ 33.92 12.94+a

a. PAID HOLIDAYS: Labor Day, Veterans' Day, Thanksgiving Day and the day after Thanksgiving, Christmas Day, New Year's Day, Martin Luther King's Birthday, Memorial Day and the Fourth of July.

PLUM0602-006 11/01/2007

	Rates	Fringes
Steamfitter, Refrigeration & Air Conditioning Mechanic (Including HVAC Pipe Work).....	$ 33.27	13.57+a

a. PAID HOLIDAYS:
New Year's Day, Martin Luther King's Birthday, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and the day after Thanksgiving Day and Christmas Day.

SFDC0669-001 04/01/2008

	Rates	Fringes
Sprinkler Fitters.....	$ 29.35	14.30

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* SHEE0100-002 07/01/2008

	Rates	Fringes
Sheet Metal Worker (Including HVAC Duct Work).....	$ 33.04	12.12

SUDC2000-001 04/12/2000

	Rates	Fringes
ASBESTOS ABATEMENT WORKER (Removal from Floors, Ceilings, Walls and Mechanical Systems).....	$ 10.60	
Laborer, Unskilled.....	$ 11.83	2.23

Pointer, caulker and cleaner
INCLUDES pointing,
caulking and cleaning of
existing masonry, brick,
stone and cement
structures (restoration
work); EXCLUDES pointing,
caulking and cleaning of
new or replacement
masonry, brick, stone and
cement.....$ 20.00

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

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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)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

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 Regional Office for the area in which the survey was conducted because those Regional Offices have 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 DECISION

OMB No. 1510-0056

ACH VENDOR/MISCELLANEOUS PAYMENT ENROLLMENT FORM

This form is used for Automated Clearing House (ACH) payments with an addendum record that contains payment-related information processed through the Vendor Express Program. Recipients of these payments should bring this information to the attention of their financial institution when presenting this form for completion. [redacted]

PRIVACY ACT STATEMENT

The following information is provided to comply with the Privacy Act of 1974 (P.L. 93-579). All information collected on this form is required under the provisions of 31 U.S.C. 3322 and 31 CFR 210. This information will be used by the Treasury Department to transmit payment data, by electronic means to vendor's financial institution. Failure to provide the requested information may delay or prevent the receipt of payments through the Automated Clearing House Payment System.

AGENCY INFORMATION

FEDERAL PROGRAM AGENCY: ARCHITECT OF THE CAPITOL

AGENCY IDENTIFIER:

AGENCY LOCATION CODE (ALC): 01-00-0001

ACH FORMAT: ☐ CCD+ ☐ CTX

ADDRESS: 2ND & D STS., SW, FORD HOUSE OFFICE BUILDING

WASHINGTON, DC 20024

CONTACT PERSON NAME:

TELEPHONE NUMBER: ( )

ADDITIONAL INFORMATION:

PAYEE/COMPANY INFORMATION

NAME

SSN NO. OR TAXPAYER ID NO.

ADDRESS

CONTACT PERSON NAME:

TELEPHONE NUMBER: ( )

FINANCIAL INSTITUTION INFORMATION

NAME:

ADDRESS:

ACH COORDINATOR NAME:

TELEPHONE NUMBER: ( )

NINE-DIGIT ROUTING TRANSIT NUMBER: — — — — — — — — —

DEPOSITOR ACCOUNT TITLE:

DEPOSITOR ACCOUNT NUMBER:

LOCKBOX NUMBER:

TYPE OF ACCOUNT: ☐ CHECKING ☐ SAVINGS ☐ LOCKBOX

SIGNATURE AND TITLE OF AUTHORIZED OFFICIAL:
(Could be the same as ACH Coordinator)

TELEPHONE NUMBER: ( )

BID BOND *(See instruction on reverse)*	DATE BOND EXECUTED *(Must not be later than bid opening date)*	OMB NO.: 9000-0045

Public reporting burden for this collection of information is estimated to average 25 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (MVR), Federal Acquisition Policy Division, GSA, Washington, DC 20405.

PRINCIPAL *(Legal name and business address)*	TYPE OF ORGANIZATION *("X" one)*
	☐ INDIVIDUAL ☐ PARTNERSHIP ☐ JOINT VENTURE ☐ CORPORATION
	STATE OF INCORPORATION

SURETY(IES) *(Name and business address)*

PENAL SUM OF BOND					BID IDENTIFICATION	
PERCENT OF BID PRICE	AMOUNT NOT TO EXCEED				BID DATE	INVITATION NO.
	MILLION(S)	THOUSAND(S)	HUNDRED(S)	CENTS	FOR *(Construction, Supplies, or Services)*	

OBLIGATION:

We, the Principal and Surety(ies) are firmly bound to the United States of America (hereinafter called the Government) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown opposite the name of the Surety. If no limit of liability is indicated, the limit of liability is the full amount of the penal sum.

CONDITIONS:

The Principal has submitted the bid identified above.

THEREFORE:

The above obligation is void if the Principal - (a) upon acceptance by the Government of the bid identified above, within the period specified therein for acceptance (sixty (60) days if no period is specified), executes the further contractual documents and gives the bond(s) required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms by the principal; or (b) in the event of failure to execute such further contractual documents and give such bonds, pays the Government for any cost of procuring the work which exceeds the amount of the bid.

Each Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Government. Notice to the surety(ies) of extension(s) are waived. However, waiver of the notice applies only to extensions aggregating not more than sixty (60) calendar days in addition to the period originally allowed for acceptance of the bid.

WITNESS:

The Principal and Surety(ies) executed this bid bond and affixed their seals on the above date.

PRINCIPAL

SIGNATURE(S)	1. *(Seal)*	2. *(Seal)*	3. *(Seal)*	*Corporate Seal*
NAME(S) & TITLE(S) *(Typed)*	1.	2.	3.	

INDIVIDUAL SURETY(IES)

SIGNATURE(S)	1. *(Seal)*	2. *(Seal)*
NAME(S) *(Typed)*	1.	2.

CORPORATE SURETY(IES)

SURETY A	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		

SURETY B	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY C	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY D	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY E	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY F	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY G	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		

INSTRUCTIONS

1. This form is authorized for use when a bid guaranty is required. Any deviation from this form will require the written approval of the Administrator of General Services.

2. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.

3. The bond may express penal sum as a percentage of the bid price. In these cases, the bond may state a maximum dollar limitation (e.g., (e.g., 20% of the bid price but the amount not to exceed_____ dollars).

4. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitation listed therein. where more than one corporate surety is involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designed "SURETY(IES)" on the face of the form, insert only the letter identification of the sureties.

(b) Where individual sureties are involved, a completed Affidavit of Individual surety (Standard Form 28), for each individual surety, shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning its financial capability.

5. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal"; and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.

6. Type the name and title of each person signing this bond in the space provided.

7. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "offeror."

UNITED STATES CAPITOL POLICE
WASHINGTON, D.C. 20510-7218

CP-491
(4-04)

REQUEST FOR CHECK OF CRIMINAL HISTORY RECORDS

Please report with: (1) A valid form of photo identification, (2) and this form to the Fairchild Building located at 499 South Capitol Street SW Washington, D.C., Room 127 between the hours of 7am until 3pm Monday through Friday for processing.

1. *Name:* (Last, First, Middle)

Address:
Street & No. _____
City & State: _____
Zip: _____ Tele: _____

2. *Other Names Ever Used:* (e.g. maiden name, nickname, ect. *If you have never used another name write "None".)*

3. *Date of Birth:* (Month, Day, Year)

4. *Birthplace:* (City and State or Country)

5. *Social Security Number:*

6. *Gender:*
Male Female

7. *Race:*

8. *Height:*

9. *Weight:*

10. *Eye Color:*

11. *Hair Color:*

SIGNATURE AND RELEASE OF INFORMATION:

READ THE FOLLOWING CAREFULLY BEFORE YOU SIGN:

- I understand that the information provided above will be used to check the criminal history records of the Federal Bureau of Investigation (FBI).
- I consent to the use of the information provided in making a security determination concerning me.
- I certify that, to the best of my knowledge and belief, all of the information provided above is true, correct, and complete, made in good faith.

12. Signature: _____

13. Date: _____

Dirksen Senate Office Building
Infrastructure Improvements
Phase I - Task 9

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SECTION 01000- GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS:

A. **General Requirements**: The provisions or requirements of Division-1 apply to entire work of Contract and, where so indicated, to other elements which are included in project, and include, but are not limited to the following:

1. Summary of the Work.
2. Project Coordination.
3. Definitions and Standards.
4. Schedules and Reports.
5. Submittals.
6. Temporary Facilities and Controls.
7. Products.
8. Project Closeout.

1.2 SUMMARY OF THE WORK:

A. **Project/Work Identification**:

1. **General**: Project name is Dirksen Senate Office Building. Infrastructure Improvements, Phase 1, Task 9; Washington, D.C., as shown on Contract Documents prepared by the Architect of the Capitol (AOC). Drawings and specifications are dated 30 June 2005.
2. **Summary by Reference**: Work of the Contract can be summarized by references to the SCHEDULE, GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, Official Procedure for Making Changes in Contracts, Specification Sections, Drawings, Amendments and Modifications to the contract documents issued subsequent to the initial printing of this Project Manual and including, but not necessarily limited to, printed material referenced by any of these.
3. **Abbreviated Written Summary**: Briefly and without force and effect upon the contract documents, the work of the Contract can be summarized as follows:

   a. **Fabrication and** installation of temporary, rooftop air-handling units, including structural support system for the temporary roof-mounted air-handling units.
   b. **Removal of** existing air-handling units from Seventh Floor mechanical rooms, including removal of asbestos- and lead-containing materials from air-handling units, piping, and associated appurtenances.
   c. **Fabrication and** installation of new air-handling units in Seventh Floor mechanical rooms.
   d. **Installation of** new BACnet- compatible, direct digital control (DDC) system serving the new air-handling units in the Seventh Floor mechanical rooms.
   e. **Air balancing** air-handling units to ensure air flows indicated on the drawings.
   f. **Extending the** existing building fire suppression sprinkler system in the Seventh Floor mechanical room, including piping and sprinklers.

g. **All panelboards** and motor control centers in the Seventh Floor mechanical room, as indicated on the drawings, will be replaced.
h. **Architectural work** includes roof flashings, miscellaneous painting, concrete, and troweled floor finish inside air-handling units.

4. **Informational Drawings:** Drawings indicated as "For Information Only" are included for convenience with the Contract Documents and are NOT Contract Documents. These drawings contain information requested by the AOC for the use of the Architect and other consultants to the AOC. The Contractor is expected to independently verify all information shown and provide his own surveys, testing, and verification of conditions shown therein.
5. **Use of the Contract Documents:** The Contract Documents are comprised of the Drawings (produced by several disciplines), the Specifications, the Amendments, the Contract, approved Changes and other directives. These documents are not to be used separately for bid or construction as they represent the entirety of the project. The Contractor is responsible for ensuring that the documents are used together.
6. **Phasing Plan**: The Contractor shall follow the phasing plan shown on Contract Drawing No. DSOBM001.

B. **Contractor Use of Premises**:

1. **General**: The Contractor shall limit his use of the premises to the work indicated, so as to allow for the Government's occupancy and use by the public.
2. **Contractor Use of the Existing Building**: During the construction period the site and the building will be occupied by Members of Congress, other Government employees and the general public. Maintain the existing building in a safe and weather-tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. Cooperate fully with the Architect or his representative during construction operations to minimize conflicts and to facilitate Government usage.

   a. **Clear Passage**: Keep public areas such as hallways, stairs, elevator lobbies and toilet rooms free from accumulation of waste material, rubbish or construction debris. Where tools or debris may fall from overhead, provide covered enclosure.
   b. **Smoking or open fires** will not be permitted within the building enclosure or on the premises.
   c. **Temporary Elevator Use**: The Architect will designate elevators available for use of Contractor's personnel. Use of other than designated elevators will not be permitted.

3. **Limitations on Use of the Site**: Limitations on site usage as well as specific requirements that impact site utilization are indicated on the Drawings and by other Contract Documents. Portions of the site beyond areas on which work is indicated are not to be disturbed. In addition to these limitations and requirements, administer allocation of available space among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so

as to minimize space and time requirements for storage of materials and equipment on site.

a. **Noise-producing** activities shall be limited to the hours between 10:00 p.m. and 7:00 a.m..
b. **Provide 3** weeks advance notice for each required system shutdown to allow for appropriate notice to be issued to the building occupants.
c. **Access for** the Contractor's personnel shall be through the Northeast Door of the DSOB, First and C Streets, Northeast. Personnel will be required to show their issued identification and will enter the building through a magnetometer.
d. **Deliveries of** materials and equipment will be checked by the United States Capitol Police. Deliveries in open trucks will be screened at the jobsite. Notify the Architect's representative a minimum of 48 hours in advance of each delivery to the site to allow for coordination with the United States Capitol Police. All other deliveries shall be screened at the United States Capitol Police off-site screening facility prior to delivery to the jobsite.
e. **Keep existing** driveways and entrances serving the premises clear and available to the Government and its employees at all times. Do not permit trucks of any kind to use existing sidewalks without prior authorization of the Architect.
f. **Maintain driveways** between and around combustible material storage piles at least 15 feet wide and free of accumulation of rubbish, equipment and materials. Maintain access for fire fighting equipment.
g. **Do not unreasonably** encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off-site.
h. **Provide 24hr/7day** access to the building by emergency vehicles and firefighting equipment.

4. **Construction Parking Control**: Parking space for personal vehicles is not available on the site. Obtain approval of Architect for parking of construction motor vehicles or other equipment on the site.

C. **Government Occupancy**: The Government reserves the right to place and install equipment as necessary in completed areas of the building and to occupy such areas prior to final acceptance, provided that such occupancy does not substantially interfere with completion of the work. Such placing of equipment and partial occupancy shall not constitute acceptance of the work or any part of the work.

D. **Protection of Government Property**: The Contractor is expected to take all reasonable precautions to protect U.S. Government Property. In the event of damage to or theft of Government Property, the Contractor will be held fully responsible for his own personnel, his subcontractor's personnel and their actions.

E. **Blasting**: The use of any kind or type of explosive in the performance of the work is prohibited, except the use of construction tools actuated by or employing powder-actuated charges which shall be permitted, provided that the tool is of the kind and design ordinarily used for such

construction and that the Architect has authorized its use after determining that its use will not endanger human life or safety.

F. **Mechanical/Electrical Requirements of General Work**: Except as otherwise indicated, comply with applicable provisions of The National Electrical Code (NEC) and standards by National Electrical Manufacturer's Association (NEMA) for electrical components of general work. Where applicable, provide products listed and labeled by nationally recognized independent testing and labeling organizations.

1.3 **PROJECT COORDINATION**:

A. Meeting records and correspondence shall be electronically generated in Word or WordPerfect format. Provide computer disk of all transactions.

B. **Coordination and Meetings**: Prepare a written memorandum on required coordination activities. Include such items as required notices, reports and attendance at meetings. Distribute this memorandum to each entity performing work at the project site. Prepare similar memorandum for separate contractors where interfacing of their work is required.

1. **Continuously coordinate** the work of subcontractors to ensure proper processing and progress of the work. Require each subcontractor to examine work of other trades and all sections of specifications to assure satisfactory installation of, and connection between, his work and work of other trades.

a. **Provide other parties**, to the extent their work is affected by this work, all information necessary for the proper execution of their work. Arrange and conduct work so that other parties may complete their work at the site according to schedule. All work under this contract shall be carefully coordinated with work under other such contracts.

2. **The Contractor** shall maintain a complete set of Contract Documents on the site during the execution of this contract. All Drawings and Specifications shall be posted with the latest information and Changes.

C. **Surveys and Records/Reports**: Working from lines and levels established by the property survey, establish and maintain bench marks and other dependable markers. Establish bench marks and markers to set lines and levels for work at each story of construction and elsewhere as needed to properly locate each element of the project. Calculate and measure required dimensions as shown within recognized tolerances. Drawings shall not be scaled to determine dimensions. Advise entities performing work of marked lines and levels provided for their use. Advise Architect promptly upon detection of deviations that exceed indicated tolerances.

D. **General Installation Provisions**:

1. Comply with the most current federal OSHA and other safety regulations applicable to the work.

2. **Pre-Installation Meetings**: Hold a pre-installation meeting at the project site well before installation of each unit of work which requires coordination with other work. Installer and representatives of the manufacturers and fabricators who are involved in or affected by that unit of work, and with its coordination or integration with other work that has preceded or will follow, shall attend this meeting. Advise Architect of scheduled meeting dates.
3. **Installer's Inspection of Conditions**: Require the Installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The Installer shall report all unsatisfactory conditions in writing to the Contractor. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
4. **Manufacturer's Instructions**: Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents.
5. **Mounting Heights**: Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for the particular application indicated. Refer questionable mounting height choices to the Architect for final decision.

    a. **Mount units of work** required to be accessible to handicapped people at heights prescribed by the Uniform Federal Accessibility Standards as referenced by the Americans with Disabilities Act (ADA) (Fed. Reg./Vol. 56, No. 144/Part 36).

E. **Cleaning and Protection**: During handling and installation of work at the project site, clean and protect work in progress and adjoining work on the basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of completion.

1. **Clean and perform maintenance** on installed work as frequently as necessary through remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
2. **Limiting Exposures of Work**: To the extent possible through reasonable control and protection methods, supervise performance of the work in such a manner and by such means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period.

    a. **Protect against possible damage** all sills, jambs and soffits of permanent openings used as passageways or through which materials are handled. Protect exposed corners, spandrels, projecting features and similar permanent work subject to damage. Cover and protect all prefinished work from damage by mortar, plaster, gypsum drywall compounds, paint, and other construction materials and operations. Use wheelbarrows equipped with rubber tires over permanently exposed floors and paving. Provide special protection for works of art, as prescribed in the Contract Documents.

3. **Load all trucks** leaving the site with earthen materials or loose debris in a manner that will prevent dropping of materials on streets. Fasten suitable tarpaulins over the load before they enter surrounding paved streets. Trucks bringing earthen materials over paved streets to the site shall be similarly covered.
4. **Clean sidewalks and streets** adjacent to site daily or more often as necessary, of debris spillage or mud/dirt tracked from loading and trucking involved in construction operations. Maintain suitable truck wheel washing installation and crew to prevent any mud from being carried onto adjacent paved streets. Conform to local regulations regarding load limits.

F. **Cutting and Patching**: Where the Contractor must cut, patch, alter, add to, repair or refinish existing construction and finishes which are not to be removed, comply with requirements specified in Division 01 Section "Cutting and Patching."

1. **Construction, finishes,** equipment and other items which are damaged or defaced by reason of work performed under this contract shall be restored to the satisfaction of the Architect.
2. **Structural elements**: Foundation construction, bearing walls, structural concrete, structural steel, structural deck, lintels, miscellaneous structural metals, stairs, equipment supports, piping, ductwork, vessels and equipment, structural elements of other construction.

   a. Do not cut or patch in a manner that would reduce load-carrying capacity or load-deflection ratio.
   b. Notify Architect of proposed cutting and patching procedures, and obtain written approval, before proceeding.

G. **Conservation and Salvage**: It is a requirement for supervision and administration of the work that construction operations be carried out with the maximum possible consideration given to the conservation of energy, water and materials. In addition, maximum consideration shall be given to salvaging materials and equipment involved in performance of the work but not incorporated therein. Refer to other sections for required disposition of salvage materials which are the Government's property.

1. **Architect Notification**: To allow time for the Architect to observe the construction, provide a minimum of 48 hours notice of excavation work, completion of steel reinforcing, pouring of concrete, paving operations, utility work, trenching, tree removal or replacement, commencements of next phase of work, and other tasks to be identified by the Architect.

1.4 DEFINITIONS AND STANDARDS:

A. **General**: Comply with governing regulations and the codes and standards imposed upon the work. These requirements include the obtaining of permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

B. **Definitions**: A substantial amount of specification language consists of definitions for terms found in other contract documents, including the drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon). Certain terms used in contract documents are defined in this article. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the work to the extent that they are not stated more explicitly in another element of the contract documents.

1. **Installer**: The term "installer" is defined as the entity (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (installers) be expert in the operations they are engaged to perform.
2. **Testing Laboratory**: The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.
3. **Indicated**: The term "indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate cross-reference, and no limitation is intended except as specifically noted.
4. **Furnish**: Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
5. **Install**: Except as otherwise defined in greater detail, the term "install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
6. **Provide**: Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
7. **Exposed**: The term "exposed" is defined as an item or surface, exterior or interior, which can be seen by a person outside the building or a person inside a usable space within the building during normal activity.

    a. Mechanical and electrical rooms, air handling rooms, storage rooms and penthouses shall be considered to have exposed surfaces, as shall the mechanical and electrical construction within them.
    b. The interiors of closets and alcoves shall be considered exposed surfaces, and shall be finished to match the finish of the adjoining room or space, unless another finish is otherwise indicated.
    c. The interiors of cabinets shall be considered exposed, but a finish different from that of the exterior may be permitted or required by other sections.

8. **Concealed**: The term "concealed" is defined as an item or space not normally seen, occupied or used by building occupants or staff, such as shafts, hoistways, tunnels, ceiling plenums, attics, and crawls spaces.

9. **Finished Space**: The term "finished space" is defined as space normally used by the public, building occupants or staff for primary functions of the building, but does not include mechanical, electrical and elevator equipment rooms, hoistways, tunnels or mechanical penthouses, unless otherwise indicated.
10. **Specialist**: The term "specialist" is defined as an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the contract specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

C. **Format and Specification Content Explanations**: Bolding and underscoring: Are used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where bolding and underscoring are used. Imperative language is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by Contractor, or when so noted, by others.

1. **Abbreviations**: The language of specifications and other contract documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with titles of general standards which are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the contract documents so indicates.
2. **Minimum Quality/Quantity**: In every instance, the quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may surpass the quality of that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimum or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to the Architect for decision before proceeding.

D. **Overlapping and Conflicting Requirements**: Where there appears to be overlapping or conflicting requirements in the drawings and specifications, refer all such questions in writing to the Architect for interpretation. Do not proceed with that portion of the work that is under question until the Architect has replied in writing. Delays necessitated by requests for interpretation shall not form the basis for a Change to the contract. The Architect's interpretation and decision shall be final. Procedures for resolving disagreements with the decision of the Architect are outlined in the General Conditions of the Contract. The order of precedence is established as follows:

1. **Order of Precedence:** Any inconsistency in this solicitation or Contract shall be resolved by giving precedence in the following order:

   a. The Schedule (excluding the specifications).
   b. Representations and other instructions.
   c. Contract clauses.
   d. The Specifications.
   e. The Drawings. Large scale drawings take precedence over small scale drawings. Do not scale drawings.

2. **Industry Standards**: Where compliance with two (2) or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into contract documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to the Architect for a decision before proceeding.
3. **Contractor's Options**: Except for overlapping or conflicting requirements, where more than one set of requirements are specified for a particular unit of work, Options are intended to be the Contractor's regardless of whether or not it is specifically indicated as such.

E. **Drawing Symbols**: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., Ninth edition.

   1. **Mechanical/Electrical Drawings**: Graphic symbols used on mechanical and electrical drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, these symbols are supplemented by more specific symbols as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Architect for clarification before proceeding.

F. **Industry Standards**: Except to the extent that more explicit or more stringent requirements are written directly into contract documents, applicable standards of the construction industry have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies were bound herein, subject to the order of precedence previously stated.

   1. **Publication Dates**: Except as otherwise indicated, where compliance with an industry standard is required, conform to the standard in effect on the date of the Invitation for Bids, or, if referred to in any Amendments, at the date of such Amendments.
   2. **Abbreviations and Names**: The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of the date of contract documents:

AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
IEEE	Institute of Electrical and Electronics Engineers www.ieee.org	(212) 419-7900
NAAMM	National Association of Architectural Metal Mfrs www.naamm.org	(312) 332-0405
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NRCA	National Roofing Contractors Association	(800) 323-9545

	www.nrca.net	(847) 299-9070
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

G. **Federal Government Agencies**: Names and titles of federal government Standard- or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of Standard- or Specification-producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	 (888) 293-6498 (202) 512-1530
EPA	Environmental Protection Agency www.epa.gov	(800) 438-2474
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	 (215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
OSHA	Occupational Safety and Health Administration www.osha.gov	(800) 321-OSHA (6742)

H. **District of Columbia Government Agencies**: Names and titles of local government Standard- or Specification-producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of Standard- or Specification-producing agencies of the DC government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

DC-EHA	Environmental Health Administration Department of Health Government of the District of Columbia 51 N Street. N.E, Room 5030-B Washington, DC 20002 dchealth.dc.gov	(202) 535-2500
DDOT	District Department of Transportation 2000 14th Street, NW, 6th Floor Washington, DC 20009	(202) 673-6813
WASA	District of Columbia Water and Sewer Authority 5000 Overlook Avenue, S. W. Washington, DC 20032 www.dcwasa.com	(202) 787-2427

1.5 **SCHEDULES & REPORTS**:

A. Meeting records shall be electronically generated in Word or WordPerfect. Schedules shall be generated in XL spreadsheets. Provide a computer disk with all project transactions.

B. **Coordination**: Coordinate both the listing and timing of reports and other activities required by provisions of this and other sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the Architect.

C. **Material Schedule**: Prior to commencing work, submit for approval the names of manufacturers and the trade names or numbers of all materials proposed for use on the project. Do not use any material until approved by the Architect. Upon request, furnish samples of materials, without cost to the Government, for examination and testing.

1. **Submit 3 copies** of the product-listing schedule prior to commencement of the Work. Provide a written explanation for omissions of data, and for known variations from contract requirements.

D. **Schedule of Values:** Within thirty (30) calendar days of the date of contract award, a Schedule of Values shall be submitted. This schedule is defined as a work item by work item breakdown of cost of each definitive work activity including Contractor's markup. The Schedule of Values shall directly correlate with the Phases of Work indicated on the approved Progress Schedule specified below.

1. The Grand Total of all of the Schedules shall equal Contractor's original bid.
2. The proper updating of both the Schedule of Values and the Record Drawings shall be considered precedent to approval of Partial Payments.

E. **Shop Drawing Submittal Schedule:** Within thirty (30) calendar days of the date of contract award, a Shop Drawing Submittal Schedule shall be submitted. The schedule shall indicate

at a minimum, all shop drawing submittals to be made, their contents, each specification section the submittal is drawn from, the date on which it will be submitted, the expected return dates, and the subcontractor responsible for creating the submittal. The submittal will be reviewed by the Architect as the first shop drawing submittal and comments made must be acknowledged and employed in the resubmission prior to the submittal of any other shop drawing. Do not "Load" the schedule.

F. **Fully Developed Progress Schedule**: Within 60 days of the date of contract award, the Contractor shall prepare and submit for approval a comprehensive bar-chart type progress schedule indicating, by stage-coded symbols, a time bar for each major category or unit of work to be performed at the site; include minor elements of work which are, nevertheless, involved in overall sequencing of the work. Arrange the schedule to show how final acceptance is scheduled to allow for the Architect's procedure for certification of final acceptance. Prepare the schedule on sheets of stable transparency, or other reproducible material, to permit reproduction for the required distribution.

1. **Cost Correlation**: Immediately below the date line at the heading of the bar-chart, provide a two item cost correlation line, indicating both "precalculated" and "actual" costs. This cost correlation line shall show dollar-volume of work performed as of the same dates used for preparation of partial payment requests. Refer to GENERAL CONDITIONS for cost reporting and payment procedures. In so far as it is practical to do so, use the same units of work in the progress schedule as indicated in the "schedule of values" required by the GENERAL CONDITIONS and further specified above.
2. **Schedule Updating**: Following its initial approval, the project schedule shall be updated monthly for the purpose of recording and monitoring progress of the Work and establishing the values of progress payments. If the Work falls behind schedule, revise schedule and describe action to be taken to insure that work will be completed within the Contract time. Any adjustment to the Contract Time shall be made in accordance with the GENERAL CONDITIONS. For each schedule update, prepare a narrative report which shall include a description of all activities completed during the preceding month, description of progress made and planned activities listed as started but not completed on the updated Progress Schedule, and a written description and justification of any proposed revision to the logic sequence.

    a. **Contractor Revisions**: The Contractor may also request revisions to the logic sequence and schedule of the Progress Schedule in the event that his planning for the project is revised. If revisions to the approved Progress Schedule are desired, the Architect shall be notified in writing for his approval, stating reasons for proposed revision. If the Architect considers such proposed revisions to be of a major nature, he may require the Contractor to revise and resubmit for approval, without additional cost to the Government, all or the affected portion of the schedule to indicate the effect on the entire project. Provide two weeks notice to the Architect, in writing, prior to submitting any Contractor proposed revisions not discussed in a previous Progress Meeting.

b. **Architect Revisions**: Architect-directed revisions to the Progress Schedule will be forwarded to the Contractor with a ten (10) calender day Contractor response period. The Contractor shall either assent to the proposed change or state reasons for not implementing the proposed revision.

c. **Progress Updates**: Revisions to the Progress Schedule made to reflect actual work progress to date are not revisions to logic sequence and schedule. In disagreements concerning actual progress recorded to date, the Architect's determination shall govern.

3. **Distribution**: Following the initial submittal to and response by the Architect, print and distribute progress schedules to the Architect (3 copies), separate contractors, the principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. When revisions are made, distribute updated issues to the appropriate entities.

G. **Progress Meetings and Documentation**: In addition to specific coordination and pre-installation meetings for each element of work, and other regular project meetings held for other purposes, hold a general progress meeting each month with time coordinated with preparation of the partial payment request. Require each entity then involved in planning, coordination or performance of work to be properly represented at each meeting. Discuss status of each element of current work in relation to Progress Schedule. Determine how behind-schedule work will be expedited, and secure commitments from entities involved in doing so to ensure that work will be completed within Contract Time.

1. **Initial Progress Meeting**: Schedule initial progress meeting, recognized as "Pre-Construction Meeting", for a date not more than 15 days after date of Notice to Proceed. Use it as an organizational meeting, and review responsibilities and personnel assignments.
2. **Daily Reports**: Prepare a daily report, recording information concerning events at the site; and submit duplicate copies to Architect on at least weekly intervals.

H. **Permits, Licenses, and Certificates**: For the Government's records, submit copies of utility permits, licenses, certifications, utility inspection reports, releases, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

I. **As required** in "Limitations on Use of Site" above, submit written request 3 weeks in advance for each required system shutdown (outage), and coordinate with the Architect.

1. **Scheduling** a system shutdown: Schedule shutdowns for times between Saturday 8:00 p.m. and Sunday 6:00 a.m. Provide the number of workers, with the required skills to accomplish all necessary work during the scheduled shutdown.
2. **Approved shutdown** requests may be cancelled at any time up to the last minute.

1.6 **SUBMITTALS**:

A. **General**: Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents. The Contractor is responsible for all dimensions, for the design of adequate or proper components, connections and other items, for the inclusion in the work of all elements and incidental details, and for the satisfactory fabrication, construction, operation and coordination of the work.

1. **Approval** of any submission shall not be construed as a complete or precise check of the item submitted but will only indicate that the general methods of design, detailing, construction or other elements under consideration appear to be satisfactory, without specific determinations or particulars.
2. **Changes to the Contract** will not be made by notations on submittals. In the event submittals returned by the Architect with notations, which in the opinion of the Contractor, constitute additional work for which he is entitled to an adjustment in the contract sum or the contract time, the Contractor shall comply with the procedure set forth in Article, "Changes," of the GENERAL CONDITIONS.
3. **Do not permit** submittal copies without an appropriate final "Action" marking by the Architect to be used in connection with the work.
4. **Submissions of "Approved Equals:"** In addition to standard submittal requirements, for each item submitted as an "approved equal" submit the following:

    a. **Comparison of** proposed approved equal's characteristics with the salient characteristics of the specified product demonstrating that the proposed approved equal fully meets or exceeds the specifications,
    b. **Drawings and** samples as required for specified products,
    c. **Any changes** required in other elements (if any) because of the submission of the proposed approved equal, and
    d. **A listing of** sources of supply, maintenance service (if applicable), and replacement parts.

B. **Submittal Procedures**: Make all submittals to the Architect or to an individual designated by the Architect.

1. **Only the Architect** or an individual designated by the Architect can approve or disapprove submittals. Deviations and variations from the contract requirements contained in the submittal can be approved only by the Architect or by an individual delegated such authority by the Architect.
2. **Costs** associated with transmittal of submittals shall be borne by the Contractor.
3. **Review Time**: Except as specified elsewhere, allow for a review period of thirty (30) calendar days after receipt of the submittals by the Architect. Advise the Architect on each submittal, as to whether processing time is critical to the progress of the work, and if work would be expedited if processing time could be shortened. No extension of time will be authorized because of the Contractor's failure to transmit submittals or re-submittals to the Architect sufficiently in advance of the work. For submittals of items requiring coordination between different trades or subcontractors, review time period starts from the time that all required submittals have been received by the Architect and ends when submittal leaves the Architect.

The Contractor is required to coordinate all work involving associated sub-trades and produce coordinated drawings for submittal where required by individual specification sections or as required below.

4. **Preparation of Submittals**: Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, supplier, manufacturer, submittal name and similar information to distinguish it from other submittals. Label as to number and title of specification section, drawing number and detail references, as appropriate. Show Contractor's executed review and approval marking and provide space of not less than 20 sq. in. for the Architect's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through the Contractor's office will be returned without action.

5. **Number of Copies**: Submit a minimum of six (6) copies of each submittal requested.

C. **Specific Submittal Requirements**: Specific submittal requirements for individual units of work are specified in the applicable specification section. Except as otherwise indicated in the individual specification sections, comply with the requirements specified herein for each type of transmittal.

1. **Product Data**: Collect required product data into a single submittal for each unit of work or system. Mark each copy to show which choices and options are applicable to the project. Where product data has been printed to include information on several similar products, some of which are not required for use on the project, or are not included in this submittal, mark the copies to show clearly that such information is not applicable.

   a. **Submittals**: Submittal is for information and record, unless otherwise indicated. Initial submittal is final submittal unless returned by the Architect, marked with an action which indicates an observed non-compliance.

      1) **Initial Submittal**: Except as otherwise indicated, submit 6 copies of each required product data submittal, plus two (2) additional copies where required for maintenance manuals. The Architect will retain two (2) copies and return the other marked with "Action" and corrections or modifications as required.

2. **Shop Drawings**: Provide special notation of dimensions that have been established by field measurement. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the shop drawings.

   a. **Preparation**: Submit newly prepared information, drawn to accurate scale on sheets not less than 8-1/2" x 11"; except for actual pattern or template type drawings, the maximum sheet size shall not exceed 36" x 48". Indicate the name of the firm that prepared each shop drawing and provide appropriate project identification in the title block.

1) Do not reproduce contract documents or copy standard printed information as the basis of shop drawings.
2) Use standard architectural scales for all drawings..

b. **Coordination Drawings**: Prior to installation of sleeves and inserts for equipment, and/or the performance of work in spaces in which two or more trades are involved and in which the probability of interference exists as determined by either the Contractor or the Architect, submit composite coordination drawings for the Work. Show sequencing and relationship of separate units of work which must interface in a restricted manner to fit in the space provided, or function as indicated. In case interference develops, the Architect will decide which work shall be relocated, regardless of which was installed first. Coordination drawings are considered shop drawings and must be definitive in nature.

1) Where system or equipment is required to be arranged to provide access for operation, service, or maintenance, submit coordination drawings showing that such arrangement also provides easy access for Architect's lockout/tagout procedures.

c. **Equipment and Systems**: Shop Drawings for equipment and systems shall show ratings (where applicable), and how components are assembled, function together, and how they will be installed. Shop drawings, product data, certificate of conformance or compliance, certified test or inspection reports, and other submittals for equipment, systems, and their component parts shall be coordinated and submitted as a unit. Multiple or piecemeal submissions are not acceptable except where prior approval is obtained from the Architect, in which case a list of data to be submitted later shall be included with the first submission.

d. **Initial Submittal**: One correctable 1-1/2 mil translucent polyester reproducible print and one blue-line or black-line; reproducible will be returned.

e. **Final Submittal**: 3 prints, plus 2 additional prints where required for maintenance manuals; 2 will be retained and remainder will be returned, one of which is to be marked-up and maintained by Contractor as "Record Document."

3. Material Safety Data Sheets (MSDS): Submit information directly to Architect's Safety Officer; do not submit as action or informational submittal.

a. Architect will not review submittals that include MSDS and will return the entire submittal for resubmittal.

4. **Samples**: Documentation required specifically for sample submittals includes a generic description of the sample, the sample source or the product name or manufacturer, compliance with governing regulations and recognized standards. In addition, indicate limitations in availability, sizes, delivery time, and similar limiting characteristics.

a. **Preparation**: Where possible provide samples that are physically identical with the proposed material or product to be incorporated in the work; provide full scale, fully fabricated samples cured and finished in the manner specified. Where variations in color, pattern, or texture are inherent in the material or product represented by the sample, submit not less than 3 units of the sample, which show the full range of variations. Where samples are specified for the Architect's selection of color, texture or pattern, submit a full set of available choices for the material or product. Mount, display, or package samples in the manner specified to facilitate the review of indicated qualities. Prepare samples to match the Architect's sample where so indicated.

b. **Submittal**: Submit 3 sets of samples in the final submittal, one set will be returned. If the submittal is for the Architect's selection of color, pattern, texture or similar characteristics from a manufacturer's standard range of choices, only a single set of samples is required for a preliminary submittal. The final submittal may then be limited only to those choices selected by the Architect for final incorporation into the Work.

c. **Mock-Ups** and similar samples specified in individual work sections are special types of samples. Comply with sample submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

4. **Miscellaneous Submittals**:

a. **Inspection and Test Reports**: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

b. **Offsite Fabrication Facilities**: Provide for scheduled visits to off site fabrication facilities by the Architect. Make all facilities, including storage areas and plant, open and accessible to review of procedures, materials used and storage and shipping methods.

c. **Warranties**: Refer to Article "Products" for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish 2 executed copies of such warranties, bonds or agreements. Provide 2 additional copies where required for maintenance manuals.

d. **Staging Plan**: The Architect has indicated in plan where the Contractor can stage the construction. Submit a Staging Plan indicating specific locations of the superintendent's trailer, storage and loading of materials, traffic direction and control concept and signage, security perimeter for staging area, locations of informational construction signage, locations of temporary toilets and other temporary construction, emergency facilities and resources and any other construction facilities required.

e. **Traffic Control**: Submit a site plan and details for review and approval by the Architect to diagrammatically indicate proposed measures for safely and efficiently controlling and re-routing traffic as necessary to enable

construction work, deliveries, paving, testing operations and other activities. Indicate schedules of activities occurring hourly before, during and after the normal workday. At all times provide minimal disruption to the day-to-day activities occurring on the site and at adjacent locations.

f. **Safety Plan:** Provide as specified in Division 01 Section "Safety and Health."

5. **Closeout Submittals**: Refer to Article "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

D. **Architect's Action**: Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect will review each submittal and mark with appropriate "Action." Where the submittal must be held for coordination, the Architect will so advise the Contractor without delay.

1. **If no changes** to the drawing are required, three (3) prints and the reproducible drawing will be returned to the Contractor, bearing the stamp of the Architect, stating - "APPROVED."
2. **If changes** to the drawing are required, but are of such minor nature that fabrication and/or construction can proceed in accordance with the correction noted by the Architect without resubmission of the drawing three (3) prints and the reproducible drawing will be returned to the Contractor bearing the Stamp of the Architect stating "Approved as Noted." The Contractor shall proceed with fabrication and/or construction in accordance with the Architect's corrections, and resubmit corrected copy for the Architect's records.
3. **If changes** to the drawing are required, but are of such nature that fabrication or construction cannot proceed, three (3) prints and the reproducible drawing will be returned to the Contractor, bearing the stamp of the Architect stating - "Revise and Resubmit." In such a case, the Contractor shall resubmit the drawings, properly corrected. Upon resubmission of shop drawings, if any corrections or changes are made other than those marked by the Architect, the Contractor shall clearly indicate any such corrections or changes made on his own initiative.
4. **If the product does not meet** the specification requirements, the number of copies outlined above will be returned to the Contractor, bearing the stamp of the Architect stating - "REJECTED." In such a case, the Contractor shall submit a new product which complies with the technical specifications.
5. **Other Action**: Where the submittal is returned, marked with the Architect's explanation, for special processing or other Contractor activity, or is primarily for information or record purposes, the submittal will be marked as follows:

a. **Not Subject to Review**: This review category will apply to submittals which are not required by the Contract Documents and are inadvertently submitted and stamped; or

b. **Received/No Action Required**: This category will be used when returning "Informational Submittals" for which the Architect is not required to take action.

1.7 TEMPORARY FACILITIES AND CONTROLS:

A. **Description of Requirements**: This article specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.

1. **Use Charges**: No cost or usage charges for temporary services or facilities are chargeable to the Government. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra. All materials and equipment provided by the Contractor for temporary facilities shall remain the property of the Contractor.
2. **Materials and Execution**: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards. Do not use materials of temporary service in permanent installation.

B. **Quality Assurance**: Comply with the requirements of the District of Columbia Building Code and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.

1. **Standards**: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations"; the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition"; the NECA National Joint Guideline NJC-6 "Temporary Job Utilities and Services; and the most current versions of federal OSHA and other safety regulations applicable to the Project..

   a. **Refer** to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", as prepared jointly by Associated General Contractors of America (AGC) and American Specialty Contractors, Inc. (ASC) for industry recommendations.
   b. **Trade Jurisdictions**: The assigned responsibilities for the installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions applicable to the work.

2. **Inspections**: Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.

C. **Job Conditions**: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

D. **Temporary Utilities**: The Architect will designate a connection point for installation of temporary service to the project to existing service. Arrange with the Architect for an acceptable time when service can be interrupted, where necessary to make connections for temporary services.

1. **Temporary Electric Power Service**: Electrical energy will be supplied by the Government, but the Contractor shall install and maintain all necessary conduit, wiring, and devices needed to execute the work. Install all wiring in flexible conduit or armored cable with minimum No. 12 gage wire. Portable cords for small power tools shall be properly grounded and installed as approved by the Architect. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment. The Government will not be held responsible for power outages beyond its control.

   a. **Comply with applicable NEMA**, NECA and UL standards and governing regulations for materials and layout of temporary electric service, including those requirements included in Division-16 sections.
   b. **Install service and grounding** in compliance with the National Electric Code (NFPA 70), District of Columbia Building Code, and Power Company requirements. Include necessary service connection, service switch, meters, transformers, overload protected disconnect, main distribution switch gear, panelboards, wiring, cables, devices, and accessories.

2. **Temporary Lighting**: Provide local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy and retain light suitable for work-in-progress, access traffic, security check and project lock-up.

   a. **Provide general service incandescent lamps** of wattage indicated or required for adequate illumination. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations. Provide exterior fixtures where fixtures are exposed to weather or moisture. Keep sockets equipped with active lamps. Where feasible, utilize fluorescent type fixtures.

3. **Temporary Heating, Cooling and Ventilating**: Provide temporary heating, cooling, and ventilating where indicated or needed for performance of the Work, curing or drying of recently installed work or for protection of work in place from adverse effects of low temperatures or high humidity. Select facilities known to be safe and without deleterious effect upon the work in place or being installed. Coordinate with ventilation requirements to produce the indicated ambient condition required, to minimize the consumption of fuel or energy, and to comply with code requirements.

   a. **Maintain** a minimum temperature of 50 deg. F (7 deg. C) in permanently enclosed portions of the building and areas where finished work has been installed. Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the fuel being consumed. Do not use open burning or salamander type heating units where

prohibited by governing codes or regulations, or when combustible materials are located in or near the space being heated, or when the work installed or being installed includes work which will be exposed to view in the completed project.

1) **Do not store** fuel in building.

b. **Provide for ventilation** requirements where possible through use of natural ventilation, utilizing temporary heat and enclosures and openings to effect needed movement of air. Where necessary, install temporary fans or blowers to provide ventilation of construction spaces. Where necessary, operate units with filters and baffles to avoid distribution of dust and fumes and to minimize deleterious effects upon work. Equip portable ventilating fans with suitable safety guards.

c. **As soon as practical**, after permanent system is in place and operable, provide heat from the permanent building heating system, under operation and supervision of personnel authorized by the equipment manufacturer, until the building is complete.

1. Permanent system may be operated without diffusers and registers in place, but filters with same efficiency as those specified for permanent system must be installed in ductwork.
2. Immediately prior to acceptance by the Government, clean ducts and replace all used filters with new ones.

4. **Temporary Telephones**: Arrange for the local telephone company to install temporary service to the project or provide cellular service to the contractor's site superintendent. Location of telephones and telephone wires is subject to Architect's approval.

5. **Water Service**: Water will be provided for project use by the Government at existing sources. Provide temporary piping, connections, maintenance and other work required to deliver water required for the project.

a. As soon as construction operations at each floor level require water, extend service, the full height of the building to form a temporary water and fire water standpipe. Provide distribution piping for temporary water to each location of use. As a minimum, provide one 3/4 inch outlet for each floor level of construction spaced so that water can be reached with a 100 foot length of hose. Provide one 3/4 inch flexible rubber hose 100 feet long with an adjustable nozzle, at each outlet where work requiring water is in progress.

b. Install devices necessary to prevent backflow and cross-connections that could contaminate potable water systems, in accordance with the regulations and guidelines of the District of Columbia Water and Sewer Authority (DC WASA).

6. **Temporary Sanitary Facilities**: Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Use of the existing Government toilet facilities in the Seventh Floor mechanical room will be permitted, provided these facilities are properly cleaned and maintained in a condition acceptable to the Government. Immediately prior to Final Acceptance, restore these facilities to the condition prevalent at the time of initial use. Do not clean tools or equipment in building toilet rooms.

   a. **Supply and maintain** toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide appropriate covered waste containers for used material.

7. **Temporary Fire Protection**: Until fire protection needs may be fulfilled by permanent facilities, install and maintain temporary fire protection facilities of the types needed to adequately protect against reasonably predictable and controllable fire losses. Comply with applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher on each floor at or near each usable stairwell. Store combustible materials in clearly labeled containers in recognized fire-safe locations.

   a. **Develop and supervise** an overall fire prevention and first aid fire protection program for personnel at the project site.
   b. **Provide type "A" fire extinguishers** for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires.
   c. **Maintain an adequate safeguard** on the site for a period of thirty (30) minutes following the cessation of welding or burning operations, including but not limited to after completion of work at end of shift, lunch breaks and temporary work.
   d. **Where temporary water outlets** are available, provide hoses of sufficient length to reach construction areas. Hang hoses with a warning sign, to the effect that hoses are for fire protection purposes and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
   e. **At the earliest feasible date** in each area of the project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel at the site on how to use facilities which may not be self-explanatory.
   f. **Burn permits:** One week before planned hot operations, submit permit request to the Architect's Senate Safety Office.

E. **Temporary Construction and Support Facilities**:

1. **Field Offices and Sheds**: Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Architect. For temporary offices, fabrication shops, storage sheds and similar construction, provide either standard prefabricated or mobile units or the equivalent job-built construction.

Provide support facilities that can be maintained properly throughout their use at the project site.

a. **Provide fire-resistant construction** for offices, shops, and sheds located within the construction work area, or within 50 feet of building lines.
b. **Locate field offices**, storage and fabrication sheds and other support facilities for easy access to the Work within the allocated staging area so that facilities will not block required exits or firemen's access to the building.
c. **Except as otherwise indicated**, make the change-over from use of temporary services and facilities to use of permanent services and facilities at the earliest feasible date at each portion of the building, to minimize hazards and interferences with performance of the Work.
d. **Maintain field offices**, storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal systems, and project identification and temporary signs until near final acceptance. Immediately prior to final acceptance, with the Architect's approval, remove these facilities.

2. **Field Offices**: Provide temporary field offices of sufficient size to accommodate required office personnel and project meetings at the project site.
3. **Storage and Fabrication Sheds**: Install storage and fabrication sheds or trailers, properly sized, furnished and equipped, as required to accommodate the Work. Comply with applicable provisions specified elsewhere for distribution and use of temporary utilities.
4. **Temporary Enclosures**: At the earliest practical time provide temporary enclosure of materials, equipment, work in progress and completed portions of the Work to provide protection to the Work and employees from effects of exposure, foul weather, other construction operations, and similar activities on the site.

   a. Provide temporary enclosures where temporary heat is needed and the permanent building enclosure is not yet completed, and there is no other adequate provision for containment of temporary heat. Coordinate enclosures with ventilation and material drying or curing requirements to avoid dangerous conditions and effects.

5. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

   a. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) Type X gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on construction side.
   b. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4-inch (100-mm) studs, 2 layers of 6-mil (0.14-mm) polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 6-mil (0.14-mm) polyethylene sheets, extending sheets 18 inches (460 mm) up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch (19-mm) fire-retardant plywood.

1) Construct a vestibule and airlock at each entrance to temporary enclosure with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.

c. Insulate partitions to provide noise protection to occupied areas.
d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
e. Protect air-handling equipment.
f. Weatherstrip openings.

6. **Construction Aids**: Design, construct, and maintain construction aids and miscellaneous general services and facilities as needed to accommodate performance of the work. Construction aids and miscellaneous general services and facilities include, but are not limited to the following:

a. **Provide temporary stairs** where ladders are not adequate for performance of work, and until permanent stairs are available. Cover finished permanent stairs which will be exposed to occupants' use, with a durable protective covering of plywood or similar material so that finishes will be undamaged at the time of acceptance.
b. **Provide scaffolds** as required for proper execution of the Work. Remove or relocate scaffolds promptly to avoid interference with other trades. Provide stairs for vertical circulation.
c. **Provide adequate guardrails and barriers** at perimeters of each level of construction as work progresses in accordance with District of Columbia requirements and in conformance with requirements of the Special Conditions.
d. **Provide adequate facilities** for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. The Contractor is responsible for selection of type, size and number of facilities. Truck cranes and similar devices used for hoisting are considered as being "tools and equipment" and not temporary facilities.

1) Temporary Elevator Use: The existing freight elevators will be available during the construction period for transporting Contractor's personnel and hand tools only. Materials, equipment, gang boxes, and like items are not permitted on the existing elevators. Protect car interiors.
2) Material Hoists: Material hoists may be installed at various locations on the exterior of the building, as shown on sketch at the end of this Section. Exact locations shall be coordinated with the Architect's representative. The Architect will arrange for removal of trees or plantings, if required.
3) Other Hoisting means: As soon as practicable, but no later than 8 weeks prior to when the temporary air-handling equipment will be installed on the roof, submit proposed plan for hoisting for the Architect's review. If the hoisting plans include the use of a helicopter, a minimum of 4 weeks for approvals is necessary.

e. **Chutes**: Do not permit free dropping of materials, rubbish or debris, but remove by use of material hoist and/or rubbish chute. Locations of all hoists and chutes are subject to approval by the Architect.

1. Protect building from use of hoists and chutes to prevent damage, marring or staining of permanent work. Brace and guy securely and provide safety devices as required by code.

7. **Project Signage**: No signs, other than safety signs, may be erected on the site unless specifically indicated otherwise.
8. **Access Roads**: To the fullest extent possible, locate temporary roads and paving for storage areas and temporary parking, in the same locations as permanent facilities for similar uses. To incorporate temporary paving provisions, review significant modifications of permanent paving requirements with the Architect for acceptance of the proposed improvements.

a. **Provide temporary traffic control** facilities at the juncture of temporary roads with public roads, including warning signs for public traffic and "STOP" signs for the access road entrance onto public roads. Comply with requirements and recommendations of local traffic authorities.

F. **Security and Protection Facilities**: Provide and maintain all necessary barricades, lights, and other safeguards for the protection of Members of Congress, Government employees, Contractor's employees and the general public from injury. Protect materials and work on the site, whether incorporated in the work or not, against damage or loss from any cause.

1. **Protect all** electric, telephone, water, gas, sewer, steam, and other underground utility lines in sidewalks, streets or other areas, in, under or around the site, to the satisfaction of the Architect, the District of Columbia, and other authorities having jurisdiction. Prior to commencing work which may affect or disturb underground utilities, consult with the Architect.
2. **Provide a reasonably neat** and uniform appearance in security and protection facilities acceptable to the Architect.
3. **Except for utilization** of permanent fire protection facilities, as soon as available in each area, do not change over from use of temporary security and protection facilities to use of permanent facilities until near final acceptance, or for longer periods of time as requested by the Architect.
4. **Barricades and Fences**: Comply with recognized standards and code requirements for the erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed, including flashing red lights where appropriate.

a. Except as otherwise indicated, provide vision-proof plywood type fencing, 8-feet high, framed with four 2 x 4 rails, and with treated wood posts spaced not more than 8-feet apart. For fences and vision barriers, provide exterior type, minimum 3/8 inch thick plywood, primed and finish painted. For safety

barriers, sidewalk bridges and similar direct-contact uses, provide minimum 5/8" thick exterior plywood, primed and finish painted. See AOC details.

5. **Sidewalk Bridge and Walkway**: Erect a substantial, structurally adequate protective bridge for the passage of persons along the walkway wherever the possibility exists that materials might be hoisted from the roadway, across walkway and onto site. Coordinate with project entrance gates and other facilities and obstructions. Comply with governing regulations and requests of governing authorities.

   a. **Construct the sidewalk bridge** using heavy scaffold or shoring type framing, waterproofed heavy wood plan-K overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways and similar provisions for protection and safe passage. Paint and maintain the facility in a manner acceptable to the Government.
   b. **Construct the back wall** to serve as the project enclosure fence. Extend the framed plywood backwall beyond the bridge structure, as needed, to complete the enclosure fence.

6. **Security Enclosure and Lockup**: Install substantial and durable general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to prevent unauthorized entrance, vandalism, theft and similar deleterious effects and violations of project security. Provide copies of access keys to the United States Capitol Police.

G. **Temporary Controls**:

1. **Traffic Control**: Plan vehicular access methods, locations and timing of deliveries in a manner to minimize interference with street and pedestrian traffic and to conform to District of Columbia regulations. Do not block or obstruct public streets, driveways and walkways adjacent to the site at any time during performance of the work without proper authorization. Do not permit trucks of any kind to use existing sidewalks without prior authorization of the Architect.
2. **Collection and Disposal of Wastes**: Establish a system for daily collection and disposal of waste materials from construction areas and elsewhere on the site. Enforce requirements strictly. Do not hold collected materials at the site longer than 7 days during normal weather or 3 days when the daily temperature is expected to rise above 80 deg. F (27 deg. C). Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately.

   a. Recycle or dispose of waste in accordance with applicable federal, state, and local regulations, and cooperate with the AoC Environmental Branch to manage waste generated by the work of the project.
   b. Burying or burning of waste materials on the site will not be permitted.
   c. Washing solid waste materials down sewers or into waterways will not be permitted.

d. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of garbage and similar wastes by construction personnel.

3. **Janitorial Services**: Provide daily janitorial services for temporary offices, first aid stations, toilets, wash facilities, lunchrooms and similar areas. Require users of other temporary facilities to help maintain a clean and orderly premises.

4. **Dust Control**: During periods of construction activity creating dust conditions sprinkle periodically the site areas disturbed by Contractor's operation or treat with dust suppressors to control dust. Dry power brooming will not be permitted. Use vacuuming, wet mopping, wet sweeping or wet power brooming. Air blowing will be permitted only for cleaning non-particulate debris. Use only wet cutting procedures for unit masonry and concrete.

   a. Provide barriers constructed as required in "Temporary Partitions," above.
   b. Seal registers, grilles, and other openings to prevent dust from entering other areas.

5. **Noise Control**: Avoid the use of tools and equipment that produce harmful noise. Restrict the use of noise making tools and equipment to hours of use that will minimize noise complaints from persons or firms near the project site.

   a. Provide partitions insulated to provide noise protection as required in "Temporary Partitions," above.
   b. Conduct operations in accordance with District of Columbia noise regulations in Title 20, Chapters 27 through 29.

6. **Rodent and Pest Control**: Early in the construction process before deep foundation work has been completed, retain a recognized local exterminator or insect-and-pest control company to recommend practices that will minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so that the project will be relatively free of pests and their residues at substantial completion. Perform control operations using environmentally safe materials, in accordance with applicable federal, state, and local regulations.

7. **Environmental Protection**: Provide general protection facilities, operate temporary facilities, conduct construction activities, and enforce strict discipline for personnel on the site in ways and methods that comply with environmental regulations, and that minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site.

8. **Sewers and Drainage**:

   a. If existing sewers are available for temporary drainage near the site before completion of permanent sewers, provide temporary connections to remove effluent that can be discharged into the sewers in accordance with federal, state, and local regulations.

b. If existing sewers are not available, or cannot be used in accordance with federal, state, and local regulations, provide collection methods and containers for effluents and dispose of them off the site in accordance with federal, state, and local regulations.

9. **Snow and Ice Control**: Keep access to building and work areas clear of snow adequately to permit access while work is in progress. Do not allow snow and ice to accumulate so as to overload or otherwise endanger any portion of the Work. Do not allow snow and ice to accumulate over surfaces that can be damaged upon thawing.

H. **Installation, Operation, Termination and Removal**: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

1. **Supervision**: Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the project site.
2. **Maintenance**: Operate and maintain temporary services and facilities in good operating condition throughout the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements.

   a. **Prevent water filled piping from freezing** by use of ground covers, insulation, by keeping drained or by temporary heating. Maintain distinct markers for underground lines. Protect from damage during excavation operations. Prevent contamination of water sources.

3. **Termination and Removal**: Unless the Architect requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced by the authorized use of a permanent facility, or no later than substantial completion. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired. Contract time includes the time required for final cleanup of premises.

   a. **Remove temporary roads** and paving materials which are not intended for or acceptable for integration into permanent paving. Where the area shown is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the landscape area. Remove materials contaminated with road oil, asphalt and other petro-chemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
   b. **Immediately prior to final acceptance**, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.

c. **Restoration of Site and Adjacent Areas** : Restore the site and the adjacent areas used for staging, traffic, protection and storage of materials to their conditions prior to start of work. This includes, but is not limited to all site improvements, signage, lighting, street furniture, paving, sprinkler systems, utilities, plant, trees and turf materials. Procedures which may be required include de-compaction of compacted soils, addition of soil amendments, aeration, re-grading and removal of contaminated materials or other procedures as may be necessary.

1.8 **PRODUCTS**:

A. **General**: Refer to clause, "Materials and Workmanship," of the GENERAL CONDITIONS. After execution of the Contract, the Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "contract modifications," and are subject to the requirements specified in Architect of the Capitol, "Official Procedure for Making Changes in Contracts." Revisions to the contract documents, where requested by the Architect are considered as "changes" not substitutions.

B. **Quality Assurance**: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor. Provide a single product for each required product selection, regardless of whether that product selection is provided by more than one sub-contractor. Do not alter product brands or series for a given product selection during the life of the contract without written approval of the Architect.

1. **Source Limitations**: To the fullest extent possible and subject to the restrictions of the "Buy American Act," provide products of the same generic kind, from a single source, for each unit of work.

C. **Product Delivery, Storage, and Handling**: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces, and to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration or loss.

1. **Deliver products** to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, ventilating, and installing.
2. **Store products** at the site in a manner that will facilitate inspection and measurement of quantity or counting of units, and in conformance with manufacturer's instructions.
3. **Store heavy materials** away from the project structure in a manner that will not endanger the supporting construction.

4. Provide convenient access to Material Safety Data Sheets for each material and product.

D. **General Product Compliance**: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods.

1. **Procedures for Selecting Products**: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

a. **Performance Specification Requirements**: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.

b. **Compliance with Standards, Codes and Regulations**: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including the standards, codes and regulations.

c. **Visual Matching**: Where matching an established sample is required, the final judgement of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Architect. Where there is no product that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of the contract documents concerning "contract modifications" for the selection of a matching product in another product category, or for non-compliance with specified requirements.

E. **General Product Requirements**: Provide products that comply with the requirements of the contract documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. **Provide products** that are essentially the standard catalogued products of manufacturers regularly engaged in production of such products and that are the manufacturer's latest standard design that complies with the specification requirements. Equipment shall essentially duplicate items that have been in satisfactory commercial and industrial use at least two years, or more if otherwise specified, prior to bid opening; or in lieu thereof shall have been used and operated in a test installation which, in the opinion of the Architect, duplicate its field

performance for the same period of time. The Architect reserves the right to require the Contractor to submit evidence to this effect for his approval. When two units of the same class of equipment are required, these units shall be the product of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.

2. **Provide standard**, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Government at a later date.
3. **Nameplates**: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

F. **Installation of Products**: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

1. **Mechanical and electrical installation**: In addition to code-required access and clearances, ensure that arrangements and installations accommodate government's lockout/tagout procedures.

1.9 PROJECT CLOSEOUT:

A. **Definitions**: "Project Closeout" is the term used to describe certain collective project requirements, indicating completion of the work that are to be fulfilled near the end of the Contract Time in preparation for final acceptance and occupancy of the Work by the Government, as well as final payment to the Contractor and the normal termination of the Contract.

1. **Time of closeout** is directly related to "Final Acceptance." Therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this Division.

B. **Final Cleaning**: Special cleaning requirements for specific units of Work are included in the appropriate sections of Division 2 through 16. General Cleaning during the regular progress of the Work is required by the GENERAL CONDITIONS and is included under Article "Temporary Facilities and Controls".

1. **Cleaning**: Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.

a. **Complete the following** cleaning operations before requesting the Architect's inspection for Final Acceptance.
b. **Remove labels** which are not required as permanent labels.
c. **Clean transparent materials**, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
d. **Clean exposed** exterior and interior hard-surfaced finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
e. **Wipe surfaces** of mechanical and electrical equipment clean. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
f. **Clean the project site**, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas to a broom clean condition; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

2. **Pest Control**: Engage an experienced exterminator to make a final inspection of the project, and to rid the project of rodents, insects and other pests.
3. **Compliance**: Comply with safety standards and governing regulations for cleaning operations. Recycle or dispose of waste in accordance with applicable federal, state, and local regulations.

a. **Where extra materials** of value remaining after completion of associated work have become the Government's property, salvage or dispose of these materials to the Government's best advantage as directed.

C. **Record Documents:**

1. Maintain on site one set of the following record documents; record actual revisions to the work:

a. Contract drawings.
b. Specifications.
c. Amendments.
d. Changes to the Contract.
e. Reviewed shop drawings, product data, and samples.
f. Other record submittals, if any required in individual specification sections.

2. Maintain record documents separate from documents used for construction; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

a. Drawings: Organize into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.

3. Record information concurrent with construction progess.
4. Mark record documents with red erasable pencil, and where feasible, use other colors to distinguish separate categories of work. Note related numbers of amendments or modifications.
5. Specifications: Legibly mark and record at each section the description of actual products installed, including:

   a. Manufacturer's name and product model and number.
   b. Accepted changes made by amendments and modifications.

6. Drawings: Contract drawings and shop drawings. Mark to show the actual installation where the installed work varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" or "as-built" condition fully and accurately, but where shop drawing is marked, record a cross-reference at the corresponding location on the contract drawings. Include the following:

   a. Measured depth of foundations in relation to main floor datum.
   b. Measured horizontal and vertical locations of underground utilities and structures, relative to permanent surface construction.
   c. Measured locations of internal utilities and structures concealed in construction, relative to visible and accessible features of the work.
   d. Field changes of dimension and detail
   e. Details not on original contract drawings.

7. Submit record documents as required in "Closeout Submittals" below.

D. **Maintenance Manuals**: Organize operating and maintenance data as specified in Division 01 Section "Operation and Maintenance Data."

1. Materials and tools: Refer to individual sections of the specifications for required quantities of redundant materials, extra and overrun stock, maintenance tools and devices, keys, and similar items required. Deliver to project site and place in locations directed by the Architect; obtain receipt prior to final payment.

E. **Warranties and Bonds:** At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

b. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, project number, and the name of the Contractor.

2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

F. **General Operating and Maintenance Instructions**: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Government's personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives.

1. Instruction shall include demonstration of lockout/tagout procedures and location and operation of devices for lockout/tagout of each item of equipment.
2. Videotape each instruction session, including instructions required in technical sections for equipment. Include a complete set of videotapes with the Operation and Maintenance Data.

G. **Closeout Submittals:** Prior to requesting Final Inspection, submit the following:

1. Project Record Documents, properly annotated and in the format required.
2. Copies of Warranties and Bonds.
3. Operation and Maintenance data.
4. All required operating or special tools required in individual sections.
5. All required keys and keying schedules.

H. **Prerequisites to Final Acceptance**: Complete the following before requesting the Architect's final inspection for certification of final acceptance, and final payment as required by the GENERAL CONDITIONS. List known exceptions, if any, in the request.

1. **Submit the final payment** request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. **Submit an updated final statement**, accounting for final additional changes to the Contract Sum.
3. **Submit a certified copy** of the Architect's final punch-list of itemized work identified to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Architect.
4. **Submit final meter readings for utilities**, a measured record of stored fuel, and similar data either as of the date of substantial completion, or else when the Government took possession of and responsibility for corresponding elements of the Work.

5. **Submit** consent of surety.

I. **Reinspection Procedures**: The Architect will reinspect the Work upon receipt of the Contractor's notice that the work, including punchlist items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect.

J. **Removal of Protection**: Except as otherwise indicated or requested by the Architect, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

END OF SECTION

SECTION 01546 - SAFETY AND HEALTH

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. **General:** This section, general in nature, is applicable to all work performed under this contract and identifies some of the precautions necessary to protect the safety and health of employees, visitors, occupants and contract employees, and to prevent the loss of or damage to property and the environment.

1. Note the Construction Contractor submittal requirements outlined in Part 1 paragraph "Submittals" of this Section.

B. **Related Work:** The following sections, located elsewhere in this Project Manual, indicate the scope of work and specific measures to control hazardous materials/conditions:

1. Division 13 Section "Asbestos Abatement Procedures"
2. Division 13 Section "Lead Abatement"

1.2 REFERENCES:

A. **General:** 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. Exclusion of any specific regulations/standards required by Federal and/or local codes does not relieve the Contractor of their legal and contractual obligations to adhere to such requirements.

B. **National Standards / Code of Federal Regulations (CFRs):**

1. 29 CFR 1910 - OSHA Occupational Safety and Health Standards.
2. 29 CFR 1926 - OSHA Safety and Health Regulations for Construction.
3. 40 CFR Parts 700-799, Subchapter R - Toxic Substance Control Act (TSCA).
4. 40 CFR Parts 50-99, Air Programs.
5. 40 CFR Parts 260-299, Hazardous Waste Management System (radionuclides).
6. 40 CFR Part 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.
7. 40 CFR Parts 104-140 and 401-471, Water Programs.
8. DOT Manual of Uniform Traffic Control Devices.
9. Americans with Disabilities Act (ADA), current with updates.

C. **Related Building and System Codes:**

1. International Building Code (IBC), 2003.
2. International Existing Building Code (IEBC), 2003.
3. National Fire Code - NFPA 101, 2003.
4. International Electrical Code, 2003; and related NEMA, NECA, and UL Standards.
5. International Mechanical Code, 2003.

6. International Plumbing Code, 2003.

D. **Federal Standard 313A - Material Safety Data Sheets, Preparation and Submission.**

E. **Related** District of Columbia, state, and local regulations shall apply.

1.3 DEFINITION OF HAZARDOUS MATERIALS:

A. **General:** Refer to hazardous and toxic materials/substances, Subparts H and Z of 29 CFR 1910 and related parts of 29 CFR 1926; 40 CFR 261; 40 CFR 761 for PCBs; and to others as defined in Federal Standard 313.

B. **Those hazardous materials** most commonly encountered can include pesticides, cleaning agents, paints, adhesives, strippers, solvents, asbestos, polychlorinated biphenyls (PCB's), mercury vapor lamps, but may include others. Any unlabeled substance should be handled as hazardous material until properly identified.

C. **All suspect asbestos containing materials** (e.g., boiler insulation, duct insulation, pipe insulation), surfacing materials (i.e., plaster and sprayed-on fireproofing) and miscellaneous materials (i.e., asphalt flooring, ceiling tiles, adhesives and mastics, drywall, roofing, gaskets and cement board), must be considered asbestos containing unless proven otherwise in accordance with 29 CFR 1926.1101.

D. **Pre-1978 Surfaces:** All finished/painted surfaces of buildings constructed prior to 1978 shall be considered finished with lead based paint unless proven otherwise.

E. **Products likely to contain PCB's** include electrical transformers, capacitors, voltage regulators, oil switches, and some fluorescent light ballasts. Transformer vaults with PCB contaminated floors are identified by signage at the entry door (refer to Part 3 of this Section, article "Cautionary Procedures at Existing Vaults").

F. **Products likely to include mercury** include fluorescent light tubes, switches, gauges, thermostats, and older thermometers.

1.4 QUALITY ASSURANCE:

A. **Pre-Construction Safety Meeting:** Representatives of the Contractor must meet with the Contracting Officer and his/her representative(s) prior to the start of work under this contract. The purpose of the pre-construction meeting is to review the Contractor's Safety and Health Program and Policies, and to discuss the implementation of all safety and health provisions pertinent to the work to be performed under the contract. The Contractor shall be prepared to discuss, in detail, the measures he/she intends to take in controlling any unsafe or unhealthy conditions associated with the work to be performed under the contract. If directed by the Contracting Officer, this meeting may be held in conjunction with other pre-construction meetings such as the General Pre-Construction meeting. The level of detail of the safety meeting is dependent upon the nature of the work and the potential inherent hazards. The Contractor's principal on-site representative(s), the general superintendent and

his/her safety representative(s) shall be in attendance.

B. **Compliance With Regulations:** All work, including contact with the handling of hazardous or regulated materials, the disturbance or dismantling of structures containing hazardous or regulated materials, and/or the transport and disposal of hazardous or regulated materials shall comply with the applicable requirements of 29 CFR 1910/1926, 40 CFR, 49 CFR, and all other applicable federal, state, and local regulations.

C. **Construction Site Lighting:** Lighting intensity levels for construction areas shall meet the minimum requirements established by 29 CFR 1926.56: Illumination, including *Table D-3 - Minimum Illumination Intensities in Foot-Candles*.

D. **Compliance/Conflicts:** All work shall comply with applicable Federal, state and local safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall take precedence.

E. **Contractor Responsibility:** All Contractors shall assume full responsibility and liability for compliance with applicable regulations pertaining to the health and safety of personnel during the execution of work, and shall hold the Government harmless for any action on his/her part, or that of his/her employees or subcontractors, which results in illness, injury or death. The Contractor shall designate a single point-of-contact who is authorized to act on behalf of the contracting firm, authorized to take immediate corrective actions, and assigned the task of daily inspections and reporting outlined herein. Construction Contractors shall comply with the following additional requirements in accordance with 29 CFR 1926.16 (Prime/Subs):

1. Compliance with the accepted Accident Prevention Plan written by the prime Contractor for the specific work, submitted to the government, and reviewed by the COTR. The Contractor's plan will be job specific and will include work to be performed by the subcontractors, and measures to be taken by the Contractor to control hazards associated with materials, services, or equipment provided by suppliers.
2. Regularly scheduled safety meetings shall be held at least once a week for all supervisors on the project to review past activities, to plan ahead for new or changed operations, and to establish safe working procedures for the anticipated hazards. An outline of each meeting shall be submitted through the COTR to the Contracting Officer.
3. At least one "toolbox" safety meeting shall be conducted weekly by field supervisors or foreman for all workers. An outline report of the meeting, including date, time, duration, attendance, subjects discussed and the name of the director shall be maintained and copies furnished to the designated authority on request.

1.5 SUBMITTALS:

A. **Submittal "Punch-List:"** A submittal punch list for projects involving "other" hazardous materials as identified in the Construction Contractor's Safety and Health Program and Policies (paragraph B, below) and/or other recognized flammable, corrosive, or toxic

products identified in the referenced codes/standards.

B. **Contractor's Safety and Health Program and Policies:** Submit a Plan of Action for handling hazardous materials (except for asbestos, lead based paint, PCBs and mercury lamps as they are covered by specific sections) and/or flammable, corrosive or toxic products. Work shall not commence until the Contractor's safety program has been reviewed by the Architect. The Construction Contractor's Plan of Action shall contain the following:

1. Activity Hazard Analysis and Accident Prevention Plan: Identification of anticipated hazards, problems, and proposed mitigation measures/mechanisms.
2. Description of how applicable safety and health regulations and standards are to be met.
3. Protection of the public or others not related to the operation. Maintain code-compliant means of egress for project duration.
4. Means of protection for adjacent non-construction areas, permanent and temporary access ways, and occupants and for controlling noise/dust/fumes/debris generated by the work.
5. Contractor Safety Officer: Identify a lead Safety Officer and alternates, including 24-hour contact information for each.
6. Specialized training and experience of employees to be used for the work.
7. Type of protective equipment and work procedures to be used.
8. Material Safety Data Sheets (MSDSs) for, and proposed procedures for using, disposing of, or storing toxic/hazardous materials (also see 29 CFR1910.1200). All management and disposal of wastes shall be in accordance with Federal, states and local regulations.
9. Phasing requirements to minimize impact to non-construction work activities.
10. Emergency procedures for handling accidental spills, releases or potential exposures.
11. Interfacing of trades and control of subcontractors, if applicable.
12. Identification of any required analyses, test demonstrations, and validation requirements.
13. Hazard Communications Plan.
14. Trenching and Shoring Plan.
15. Confined Spaces employee certifications and related work procedures.
16. Multi-Employer Worksite Plan.
17. Demolition plans outlining protective measures and responsibilities required under 29 CFR 1926, Subpart T.

C. **Accident Reporting:** Serious accidents such as those resulting in: treatment of an injury at a medical facility; response by emergency medical personnel; or damage to property other than that of the Contractor will be reported to the contracting officer's representative by telephone within twenty-four hours of the occurrence. A copy of each accident report, which the Contractor or subcontractors submit to their insurance carriers, shall be forwarded through the Contracting Officer's Technical Representative (COTR) to the Contracting Officer (CO) as soon as possible (in no event later than seven (7) calendar days after the occurrence). All accidents/losses shall be reported using AOC "Incident Investigation

Report" (from AOC Safety Policy 9-4, available from the COTR) or other form that meets OSHA Standards, as required. Any incident involving fatality or permanent total disability, or property damage to the Government or other property amounting to $100,000 or more requires immediate notification of the AOC Safety and Occupational Health Branch (SOHB).

D. **MSDSs:** The Contractor shall provide copies of each MSDS, in accordance with 29 CFR 1910.1200 - *App E* and with AOC 52.223-1. One copy shall be provided to the Architect's safety officer, and a second copy shall be kept in an MSDS binder on the job site.

E. **Waste Disposal:** The Contractor shall dispose of all wastes and provide all paperwork, including but not limited to, manifests and disposal certifications, in accordance with all federal, state, and local regulations. Asbestos waste shall be accompanied by an Asbestos Shipment Record. The AOC shall sign manifests, certifications, and shipping records for lead, asbestos, and PCB wastes generated from this contract.

F. **Hot Work Permits:** When coordinating with the AOC's jurisdiction Superintendent for hot work, submit AOC designated "Hot Work Permit" (from AOC Safety Policy 10-14, available from the COTR) or other form that meets OSHA Standards, as required.

G. **Worker Certifications:** The Contractor shall provide copies of all worker certifications for handling Hazardous Materials, Working in Confined Spaces, and other certifications required by OSHA, EPA, and local regulatory agencies (not required by other technical sections in the Project Manual).

H. **Scaffolding:** All scaffolding that is erected on this job will be erected in accordance with the requirements of 29 CFR 1926, Subpart L -- *Scaffolds*. Per OSHA Standards, a scaffold erection plan will be developed by the Contractor, certified by an engineer (licensed in the District of Columba, Virginia, or Maryland) and provided to the CO prior to set up. Once in place, the Contractor's assigned safety officer shall inspect and document the conditions of the scaffold and scaffold anchor points prior to use, and once per shift thereafter. Any observed failures in the scaffold shall render it unusable until the condition is rectified and re-inspected. Weekly scaffold inspection reports shall be provided to the designated COTR for inclusion in the contract records.

1. **Other Means of Access:** Should the Contractor employ other means of access to the work area, they shall be utilized in accordance with the requirements of 29 CFR 1926, Subpart N -- *Cranes, Derricks, Hoists, Elevators, and Conveyors*. The Contractor shall submit a plan for use of such equipment, fully coordinated with any other plans for site facilities (i.e., scaffolding, staging, etc.).
2. **Scaffolding constructed** by the Contractor for use by AOC employees shall also comply with 29 CFR 1910.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. **Special facilities**, devices, equipment, clothing, and similar items used by the Contractor in the execution of work shall comply with all applicable regulations. Such materials and equipment shall be identified in the Plan of Action called for herein.

2.2 MATERIAL SAFETY DATA SHEETS (MSDSs):

A. **MSDSs** shall be available on-site for all products used under this contract. The prime contractor is responsible for meeting the hazard communication requirements, in accordance with 29 CFR 1910.1200. To the extent feasible, non-flammable, non-corrosive, and non-toxic products shall be used.

PART 3 - EXECUTION

3.1 CAUTIONARY PROCEDURES AT EXISTING VAULTS:

A. **General:** Transformer vaults may have floors which are PCB contaminated. These vaults are generally marked by blue signs, which identify the vault as PCB-contaminated; assure all vaults are marked with blue signs prior to proceeding with Work. On rare occasions, vault doors in existing buildings may be equipped with protective alarms and devices. Consult the AOC COTR to ascertain whether vault doors in areas under this contract are so equipped and have proper approved signage systems.

3.2 HAZARDOUS MATERIALS:

A. **General:** The Contractor shall bring to the COTR's attention, any material suspected of being hazardous which he/she encounters during execution of the work. The COTR shall then determine whether the Contractor shall perform tests to determine the nature or toxicity of the material. If the COTR directs the Contractor to perform tests, and/or if the material is found to be hazardous and additional protective measures are needed, a change to the contract may be required (subject to the "AOC Official Procedure for Making Changes to Contracts"). Persons conducting sampling testing and laboratories processing samples shall be certified.

3.3 CONFINED SPACES:

A. **Confined Spaces:** It is the responsibility of the AOC to identify and demarcate all known confined spaces within our facilities. It is the Contractor's responsibility to notify and coordinate with the Superintendent's Office when confined space work is to be done, obtain permission from this office to enter the space, conduct all required testing of space prior to entry, and complete an entry permit as required by OSHA regulations and the Confined Space Program previously submitted to the AOC COTR for the project.

3.4 PROTECTION:

A. **Contractor Responsibility:** The Contractor shall take all necessary precautions to prevent injury to the public, building occupants and visitors, and damage to or contamination of

property or the environment. For the purposes of this contract, the public or building occupants shall include all persons not employed by the Contractor or subcontractor thereof.

B. **Welding, Cutting, and Brazing:** The AOC specifically requires a permit for welding, cutting, and brazing. This AOC "Hot Work Permit" shall be approved each day by the AOC Superintendent's Safety Specialist, or his/her designee, and coordinated through the Superintendent's Office whenever welding, cutting or any open flame work is performed. Work areas shall be kept clear of combustibles within a 35-foot radius of any hot work. Combustibles which cannot be removed shall be covered with flame-resistant blankets. Compressed gas cylinders shall be secured in a vertical position and stored in accordance with Compressed Gas Association (GSA) Guidelines at all times. Valve protection caps shall be in place whenever cylinders are not in use, moved or stored. Appropriate fire extinguishers shall be maintained at welding and cutting operations. A designated fire watch shall sign and return the permit. The fire watch shall be on duty during operations and for a minimum of 30 minutes after completion of welding or cutting operations to ensure no possibility of fire exists.

1. Provide adequate ventilation to protect employees from fume or gas exposure.
2. During arc welding activities erect screens to shield activities.

C. **Storage:** It is prohibited to store, position, or use equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public or building occupants by its accidental shifting, ignition, or other hazardous qualities. Storing of combustible or flammable liquids shall be in accordance with the current edition of the National Fire Code for Flammable and Combustible Materials (NFPA 30). Compressed gases shall be stored in accordance with Compressed Gas Association (CGA) guidelines.

D. **Obstructions:** No corridor, aisle, stairway, door, or exit shall be obstructed or used in such a manner as to encroach upon routes of ingress or egress utilized by the public or building occupants, or to present an unsafe or unhealthy condition to the public or building occupants.

E. **Housekeeping:** Housekeeping practices shall be in conformance with OSHA 29 CFR 1910.22, 29 CFR 1910.141, 29 CFR 1910.1001, 29 CFR 1910.1025, 29 CFR 1926.25, 29 CFR 1926.62, and 29 CFR 1926.1101, for non-construction and construction contracts respectively.

F. **Protection of the Public and Federal Employees:** Work shall not be performed in any area occupied by the public or Federal employees unless the Contractor takes adequate steps for the protection of the public and Federal employees, and work is specifically permitted by the contract/COTR/jurisdiction Superintendent. Comply with requirements of ANSI A10.34.2001.

G. **Electrical Systems:** In addition to complying with the referenced standards in this Section, refer to Division 1 requirements for "Temporary Facilities and Controls." Provide compliant electrical supply, overload/ground fault protection, lighting, and signage/notification systems. Ensure that arrangements and installations accommodate the

Architect's lockout/tagout procedures.

H. **Mechanical Systems:** Mechanical systems and equipment, and the components thereof, will be arranged and installed to provide ready accessibility and ease of lock/tag application during lockout/tagout procedures for AOC employees, post construction.

I. **Fences & Barricades:** The work area shall be fenced, barricaded, or otherwise segregated from the public or building occupants to prevent unauthorized entry into the work area. Fence elements shall be installed in such a manner as to overcome the negative or hazardous effects of wind and weather typical to the region. The use of barbed wire is prohibited unless requested in writing by the Architect.

J. **Pedestrian Access Ways:** All interior and exterior paths of travel established for pedestrian circulation within and around a construction site shall meet the requirements of 28 CFR Part 36 (*ADAAG*), Appendix A (Standards for Accessible Design), Articles 4.3 through 4.5; when a path is changed to accommodate work, the Contractor shall also provide directional signage in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), 2003. All paths shall be maintained clear and level, without obstruction. Any proposed exceptions to these requirement must be approved in writing by the Architect prior to construction.

1. **Lighting:** All interior/exterior access ways, both permanent and temporary, shall be provided with a uniform minimum lighting level of 3 footcandles (fc) at the walking surface, in accordance with 29 CFR 1926.56(a), Table D-3 - *Minimum Illumination Intensities in Foot-Candles*.

K. **Alternate Precautions:** When the nature of the work prevents isolation of the work area and the public or building occupants may be in or pass through, under or over the work area, alternate precautions such as the posting of signs, warning lights, the use of signal persons, the erection of barricades or similar controls around particularly hazardous operations shall be approved and used.

L. **Work Over Thoroughfares:** When work is to be performed over a public thoroughfare such as a sidewalk, lobby, or corridor, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screens or barricades. When exposure to falling objects exists, as during the erection of building walls or during demolition, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.

M. **Temporary Construction Barriers:** Temporary construction barriers, partitions which cover a hole in a rated fire wall, protect occupants from noise or vibration, or separate the construction from public access and exit corridors shall be erected floor-to-ceiling, wall-to-wall, and shall remain in place for the duration of the contract. The minimum construction standards for these temporary barriers shall be metal studs, anchored top and bottom at a maximum spacing of 16 inches (406 mm) on-center, and covered with a minimum of one layer of ½-inch gypsum wallboard.

N. **Dust and Fume Control Measures:** Work performed adjacent to occupied areas shall be

done within dust control barriers (generally constructed of polyethylene sheeting or other barriers as approved by the Architect). To the extent feasible, maintain the work environment at a negative pressure differential with the adjoining occupied areas. The use of fume and odor producing products and materials shall be done in such a manner, or at such a time as to minimize impact on building occupants. Provide measures to minimize migration of dust, fumes, gases, and similar affects into the adjacent areas. Ensure that adequate ventilation is provided to work areas in conformance with OSHA regulations.

O. **Roof Work:** During the performance of roofing work, employees will be protected as required by the OSHA standards contained in 29 CFR 1926 - subpart M "Fall Protection."

P. **Removal of Fences and Barricades:** Fences and barricades shall be removed upon completion of the project, in accordance with local ordinance and to the satisfaction of the Contracting Officer or his/her representative(s).

Q. **Completion of Work:** Do not create or leave hazards unabated (e.g., open or absent electrical panels, unmarked circuit breakers/fuses, faceplates missing from receptacles, open maholes, un-barricaded trenches/excavations, etc.).

END OF SECTION 01546

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building.
2. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.
4. Division 13 sections for removal of asbestos-containing materials and lead-containing paint.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that

will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.
4. Piping, ductwork, vessels, and equipment.
5. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas

of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete, masonry, and plaster: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. No less than one day before patching, contact the Architect to have the work photographed by the Architect's Photography Department.
5. Proceed with patching after construction operations requiring cutting, and photographing are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

   a. Extend restoration over full surfaces to corners, joints, or other limiting edges in every direction.
   b. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   c. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove

in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01731

SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of the building.
2. Demolition and removal of selected site elements.
3. Patching and repairs.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section Cutting and Patching for cutting and patching procedures for selective demolition operations.
2. Division 1 Section Construction Facilities and Temporary Controls for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.
3. Division 1 Section Contract Closeout for record document requirements.
4. Division 15 Sections for cutting, patching, removal or relocating mechanical items.
5. Division 16 Sections for cutting, patching, removal or relocating electrical items.

1.2 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during selective demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1. Cooperate with Owner's archaeologist or historical adviser.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

H. Record drawings at Project closeout according to Division 1 Section Contract Closeout.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.5 QUALITY ASSURANCE

A. Demolition firm qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 21 days notice to Owner of activities that will affect Owner's operations.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as is practical.

C. Asbestos: Asbestos is present in the building to be selectively demolished.

1. Asbestos abatement is specified elsewhere in the Contract Documents.
2. Do not disturb asbestos or any material suspected of containing asbestos except under the procedures specified elsewhere in the Contract Documents.

D. Storage or sale of removed items or materials on-site will not be permitted.

1.7 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.8 WARRANTY

A. Existing special warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

   a. Provide not less than 5 days notice to Owner if shutdown of service is required during changeover.

B. Utility requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Arrange to shut off indicated utilities. Provide at least 21 days notice to owner.
2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
6. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

D. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) Recommended Work Practices for the Removal of Resilient Floor Coverings and Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

E. Remove no more existing roofing than can be covered in one day by new roofing. See applicable Division 7 Section for new roofing requirements.

3.6 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Division 1 Section Cutting and Patching.

C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.

D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

E. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.

1. Closely match texture and finish of existing adjacent surface.
2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

F. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION 01732

SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "General Requirements" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals and preparing Record Drawings for operation and maintenance manuals.
3. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit 6 draft copies of each manual at least 20 days before final acceptance of project by Architect. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 5 copies of each manual in final form.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of using agency.
4. Date of submittal.

5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.

6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "General Requirements."

G. Comply with Division 1 Section "General Requirements" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 03300 - CAST-IN PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL

A. Related section: Division 9 section "Painting" for yellow paint and black striping on equipment foundations (housekeeping pads).

B. Submittals: Submit the following:

1. Product data for admixtures, patching compounds, curing compounds, and others as requested by Architect.
2. Shop drawings for fabricating, bending, and placing concrete reinforcement.
3. Laboratory test reports or evaluation reports for concrete materials and concrete mix designs.
4. Written report to Architect for each proposed concrete mix at least 15 days prior to start of concreting. Do not begin concrete production until mixes have been reviewed by Architect.

C. Quality assurance: Comply with provisions of ACI 301, Specifications for Structural Concrete for Buildings, ACI 318, Building Code Requirements for Reinforced Concrete, and CRSI Manual of Standard Practice, except where more stringent requirements are indicated.

1. Concrete testing service: Engage a testing agency acceptable to Architect to perform materials evaluation testing and to design concrete mixes.

a. Materials certificates signed by concrete producer and Contractor may be submitted in lieu of materials laboratory testing when acceptable to Architect.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Form materials: Furnish form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

1. Forms for exposed concrete Surfaces: Suitable panel-type material to provide continuous, straight, smooth, exposed surfaces.

B. Reinforcing materials: As follows:

1. Deformed reinforcing bars: ASTM A 615, Grade 60, unless otherwise indicated.
2. Welded wire fabric: ASTM A 185.

C. Concrete materials: As follows:

5. Portland cement: ASTM C 150, Type 1.
6. Fly ash: ASTM C 618, Type F.
7. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
8. Water: Potable.

D. Normal-Weight Aggregrates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Lightweight Aggregate: ASTM C 330.

F. Admixtures: Provide admixtures that contain not more than 0.1 percent chloride ions.

1. Air-entraining admixture: ASTM C 260.
2. Water-reducing, retarding, and accelerating chemical admixtures: ASTM C 494.

G. Related materials: As follows:

1. Absorptive cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
2. Moisture-retaining cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap, complying with ASTM C 171.
3. Membrane-forming curing compound: ASTM C 309, Type I. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
4. Evaporation control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

H. Mix proportions and design: Proportion mixes complying with mix design procedures specified in ACI 301.

1. Limit use of fly ash to not exceed 25 percent of cement content by weight.
2. Limit use of blended hydraulic cement to no more than 35 percent of cement content by weight.
3. Design mixes to provide normal weight concrete with the following properties:

   a. Roof deck: Light weight, 3500-psi, 28-day compressive strength; water-cement ratio, 0.55 maximum.
   b. Equipment foundation (housekeeping pad): Normal weight, 3500-psi, 28-day compressive strength; water-cement ratio 0.50 maximum.

3. Slump limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

   a. Ramps, slabs, and sloping surfaces: Not more than 3 inches.

b. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.

c. All concrete: 4 inches ± 1 inch.

4. Adjust mix designs when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until laboratory test data and strength results have been submitted to and reviewed by Architect.

G. Use air-entraining admixture in exterior exposed concrete, providing not less than 4.5 percent nor more than 7 percent entrained air for concrete exposed to freezing and thawing, and from 2 percent to 4 percent for other concrete.

H. Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.

I. Job-site mixing: Use drum-type batch machine mixer, mixing not less than 1-1/2 minutes for 1 cu. yd. or smaller capacity. Increase mixing time at least 15 seconds for each additional cu. yd.

J. Ready-mix concrete: ASTM C 94.

PART 3 - EXECUTION

3.1 EXECUTION

A. Formwork: Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Select form materials to obtain required finishes.

1. Maintain formwork tolerances and surface irregularities within ACI 347 limits, Class A tolerances for concrete exposed to view and Class C tolerances for other concrete surfaces.
2. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
3. Clean and adjust forms prior to concrete placement. Apply form-release agents or wet forms as required. Retighten forms during concrete placement, if required, to eliminate mortar leaks.

B. Reinforcement: Accurately position and support reinforcement, and secure against displacement. Locate and support reinforcement to maintain minimum cover with metal chairs, runners, bolsters, spacers, and hangers as required. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

1. Install welded wire fabric in lengths as long as practicable; lap at least one full mesh and lace splices with wire.

C. Installation of embedded items: Set and build anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting diagrams, templates, and instructions provided by others for locating and setting.

D. Concrete placement: Comply with ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete, for placing concrete in a continuous operation within planned joints or sections. Do not begin concrete placement until other affected work is completed.

1. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping so that concrete is worked around reinforcement and other embedded items and into forms.

2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

a. In cold weather comply with ACI 306.
b. In hot weather comply with ACI 305.

E. Finish of formed surface: As follows:

1. Smooth-Formed Finish: Provide a smooth finish for concrete surfaces exposed to view and surfaces to be covered with a coating or covering material applied directly to concrete. Repair and patch defective areas, with fins and other projections completely removed and smoothed.

F. Slab finishes: As follows:

1. Float finish: Apply float finish to monolithic slab surfaces to receive trowel finish when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven floats. Consolidate surface with power-driven floats or by hand-floating.

a. Check and level surface plane to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

2. Trowel finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, paint, or other thin film-finish coating system.

a. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness). Grind smooth surface defects that would telegraph through applied floor covering system.

3. Trowel and fine broom finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
4. Nonslip broom finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

    a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.

G. Curing: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, apply an evaporation-control compound according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

1. Begin initial curing as soon as free water has disappeared from exposed surfaces.
2. Continue curing unformed concrete surfaces by water ponding, continuous fog spraying, continuously wetted absorptive cover, or by moisture-retaining cover curing. Cure formed surfaces by moist curing until forms are removed. Keep concrete continuously moist for not less than 72 hours for high- early strength concrete and 7 days for all other concrete.
3. Apply membrane-forming curing compound to exposed interior slabs and to exterior slabs, walks, and curbs as soon as final finishing operations are complete. Apply uniformly according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Use membrane-curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

3.2 FIELD QUALITY CONTROL

A. Engage independent testing agency to perform inspections and tests noted on the drawings.

END OF SECTION 03300

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 GENERAL

A. Structural performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Submittals: In addition to Product Data and mill test reports on structural steel and bolts, submit Shop Drawings detailing fabrication of structural steel components, including connections, splices, holes, welds, and bolts. Include manufacturer's load tables and property data for steel deck.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design.
2. ASTM A 6 (ASTM A 6M) Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.
3. Research Council on Structural Connections' (RCSC) Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

D. Welding standards: Comply with applicable provisions of AWS D1.1 Structural Welding Code--Steel.

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

E. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Structural steel shapes, plates, and bars, including smooth and threaded rod: ASTM A 36 (ASTM A 36M), carbon steel, except wide-flange shapes shall meet requirements of ASTM A 572/A572M, high-strength, low-alloy, Columbium-Vanadium structural steel.

B. Cold-formed structural steel tubing: ASTM A 500, Grade B.

C. Steel pipe: ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Adhesive (chemical) anchors: Stainless-steel threaded bolts with epoxy adhesive in glass container, capable of supporting 4 times the load imposed when tested in accordance with ASTM E 488.

E Anchor bolts, nuts, and washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.

1. Headed shear studs: ASTM A 108.

F. High-strength bolts, nuts, and washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

G. Steel deck: Properties noted on drawings.

H. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

I. Nonmetallic, shrinkage-resistant grout: Premixed, ASTM C 1107, of consistency suitable for application.

J. Fabrication: Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Comply with fabrication tolerance limits of AISC's Code of Standard Practice for Steel Buildings and Bridges for structural steel.
2. Weld connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

K. Shop priming: Shop prime steel, except surfaces embedded in concrete or mortar, surfaces to be field welded, surfaces to be high-strength bolted with slip-critical connections, and surfaces to receive sprayed-on fireproofing.

1. Surface preparation: SSPC-SP 2 Hand Tool Cleaning or SSPC-SP 3 Power Tool Cleaning.
2. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
3. Priming: Apply a 1-coat, nonasphaltic primer complying with SSPC's Painting System Guide No. 7.00 to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

PART 3 - EXECUTION

3.1 EXECUTION

A. Erect structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and bearing plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates and set on wedges, shims, or setting nuts as required.

1. Tighten anchor bolts, cut off wedges or shims flush with edge of base or bearing plate, and pack grout solidly between bearing surfaces and plates.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Connection type: Snug tightened, turn of the nut.

E. Weld connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

F. Shop and field quality control: Engage an independent testing and inspecting agency to perform shop and field inspections and tests and to prepare test reports.

1. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
3. High-strength bolted connections will be tested and inspected according to RCSC's Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
4. In addition to visual inspection, welded connections will be inspected and tested according to AWS D1.1 procedures.
5. Perform inspections and tests noted on the drawings.

END OF SECTION 05120

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Shelf angles.
2. Miscellaneous support angles.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous metal trim.

B. Related Sections include the following:

1. Division 5 Section "Structural Steel" for structural-steel framing system components.
2. Division 10 Section "Wire Mesh Partitions."

1.2 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Scale: 0.25 inch equal 1 foot. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

H. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c.

1. Width of Channels: 1-5/8 inches (41 mm).
2. Depth of Channels: As indicated.
3. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
4. Finish: Hot-dip galvanized after fabrication.

2.3 ALUMINUM

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.4 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

K. Adhesive anchors: All-thread anchor rod, nut, washer, and adhesive capsule suitable for dynamic loading and 200 degrees F ambient temperatures. Anchor sizes as shown on the drawings.

1. Rod, nut and washer: ASTM A 193 and ASTM A 563, high-strength carbon steel or stainless steel, with rolled threads. Materials as indicated on the drawings.
2. Adhesive capsule: Glass capsule containing a vinylester resin.
3. Minimum allowable working loads in 3500 psi concrete for high-strength carbon steel as follows:

Bolt Diameter (Inches)	Embedment (Inches)	Maximum Torque (Foot-Pounds)	Tension (Pounds)	Shear (Pounds)
0.0375	3.375	15	7,500	6,000
0.5	4.5	30	13,000	8,000
0.75	6.75	140	30,000	18,000
1.0	9.0	300	43,000	35,000

2.6 GROUT

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

2.7 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

C. Galvanize shelf angles to be installed in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.
2. Interior, where indicated.

2.12 FINISHES, GENERAL

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

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Provide shop primed finish on steel supports for temporary air-handling units specified in Section 15722.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Anchorage, fastenings, and connections: Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practical.

B. Adhesive anchor installation: Anchor drill size, curing time, tightening torque, hole preparation, and other installation procedures in accordance with anchor manufacturer recommendations. Rod perpendicular to wall, floor, ceiling, or slab. Two full threads shall be exposed above each anchor nut.

1. Anchor rod sediment based on:

Wall or Slab Thickness (Inches)	Embedment Depth Minimum (Inches)
3	2 1/2
4	3
5	4
6	5
8 or greater	6 1/2

2. For existing masonry and concrete construction, provide 0.025-inch pilot drilled hole to determine existing slab or wall thickness. Fill pilot hole with non-shrink grout vinylester resin. Select pilot hole locations with approval of Architect.

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

1. Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 07181 - WATERPROOF FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Layered, trowel-applied, waterproof floor surfacing.

1.3 PERFORMANCE REQUIREMENTS

A. The system shall have been tested and shown to have these minimum characteristics:

1. Waterproofness: No transmission of water when tested for 60 minutes under water at 50 psi.
2. Tensile strength of reinforcing fabric:

   a. Elongation dry: 29 percent.
   b. Breaking load dry: 79 psi.
   c. Elongation wet: 31 percent.
   d. Breaking load wet: 67 psi.

3. Strip adhesion: 19.2 psi.
4. Indentation characteristics:

   a. Steadily applied load of 2000 lbs for 30 minutes on 1 square inch: less than 5 percent.
   b. Impact of 2-lb steel ball dropped from 8 feet: No cracking or loosening.

5. Chemical resistance in accordance with ASTM D 2299: No change in texture or color when tested with industrial detergent, 20 percent saline solution, 5 percent ammonia solution, 10 percent muriatic acid solution, 10 percent chlorine solution, or kerosene. Slight temporary softening of surface when tested with turpentine or paint thinner.

1.4 SUBMITTALS

A. Product data: For the system and its components. Include manufacturer's application instructions, and chart of available colors and textures.

B. Samples for selection: No less than 2.5 by 4 inches, manufacturer's entire range of standard colors.

C. Samples for verification: Sample no less than 2.5 by 4 inches showing selected color and texture.

D. Qualification data: For qualified applicator.

E. Material certificates: Signed by the manufacturer, certifying that the flooring system has been tested and meets the specified performance requirements.

F. Maintenance data: For flooring system to be included in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer qualifications: Manufacturer's authorized representative who is trained and approved for installation of the specified waterproof flooring.

B. Source limitations: Obtain all components from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and labeled with manufacturer's product identification, directions for storage, and application instructions.

B. Maintain conditions recommended by manufacturer during storage and application.

1.7 WARRANTY

A. Special warranty: Certificate in which installers agrees to repair or replace flooring that fails in materials or workmanship within the specified warranty period.

1. Failures include, but are not limited to:

a. Deterioration of materials beyond normal use.
b. Water leaks through flooring.

2. Warranty period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATERPROOF FLOORING SYSTEM

A. Layered, trowel-applied, system including a primer bond coat, reinforced waterproof membrane, traffic surface, and color coating, designed for use in mechanical equipment rooms.

B. Rubber emulsions: Aqueous, synthetic neoprene rubber liquids containing no hydrocarbons.

C. Traffic surface: Elasticized resin emulsion containing no hydrocarbons.

D. Aggregate for traffic surface: Graded mineral aggregate passing a No. 20-mesh sieve and retained by a No. 80-mesh sieve.

E. Reinforcement: 7.5-ounce, woven, polypropylene fabric.

F. Color coating: Single-component, water-based, acrylic latex emulsion.

PART 3 - EXECUTION

3.1 PREPARATION

A. The qualified applicator shall clean the substrate where flooring is to be applied, following the flooring manufacturer's instructions for a clean, dry, and neutral surface.

3.2 APPLICATION

A. Following manufacturer's instructions, apply each component of the system, to produce a uniform, monolithic surface no less than 3/16 inch thick.

B. Apply the membrane to vertical structures such as walls and edges of concrete bases, as indicated. At straight walls or steel equipment bases, apply 4 inches high.

C. Overlap seams in reinforcing fabric no less than 2 inches.

D. Apply traffic surface uniformly over waterproof membrane. Sand surface to remove trowel marks and small surface imperfections.

E. Apply 2 coats of color coating with a roller, to a matte finish, uniform in color and texture.

F. Cure each layer of the system in accordance with manufacturer's instructions. The specified system requires at least 24 hours for curing.

3.3 MAINTENANCE INSTRUCTIONS

A. The applicator shall cooperate with the Government's maintenance personnel to identify appropriate cleaning materials and methods for the waterproof flooring system. Provide written instructions listing any materials that should not be used on the system.

END OF SECTION 07181

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Metal flashing.
2. Patching of sheet metal roofing.
3. Wood materials for blocking and other rough carpentry associated with flashing and trim.

B. Materials and methods of installation shall be compatible with existing roof materials and design.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product. Include data on elastomeric sealants, preformed foam sealant, and solder.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Permit only soldering technicians who have successfully completed an approved mock-up, as described below, to perform soldering for this project.

C. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Construct mockups for the following type of sheet metal flashing and trim:

   a. Two feet long sample of flat locked and soldered seam demonstrating full penetration of solder through seam. Sample seam to include cleats, underlayment and plywood substrate.

4. Permanently label mock-up with name of soldering technician who created it.
5. Obtain Architect's approval of mockups before start of final unit of Work. Cut completed mock-up seam in presence of architect to demonstrate full penetration of solder.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

   a. When directed, demolish and remove mockups from Project site.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Copper: ASTM B 370; temper H00, cold rolled except where temper 060 is required for forming; not less than 16 oz./sq. ft. (0.55 mm thick), unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: ASTM B 32, Grade Sn50, used with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer.

1. Use large headed copper roofing nails to fasten cleats to plywood substrate.

C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

D. Elastomeric Sealant: Single Component non-sag urethane sealant.

1. Comply with ASTM C920.
2. Type and grade: S, single component, and NS, non-sag.
3. Use related to exposure: NT, nontraffic.
4. Uses related to joint substrate: O, for copper and painted steel.

E. Felt Underlayment: 30 pound asphalt saturated, non-perforated, building felt.

F. Preformed Foam Sealant: Preformed closed-cell polyvinyl chloride foam sealant tape with pressure sensitive adhesive on one side.

1. Size: min. of 1" wide by 1/8" thick.
2. Density: 9 lbs./c.f.
3. Water Absorption (% by volume): 2.5% by NTP-35.

G. Separation Sheet: 5-lb/square (0.244 kg/sq. m) red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated, and in accordance with the "Copper in Architecture" handbook of the Copper Development Association.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

F. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer or as indicated.

G. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Cleat Size: Min. of 2" wide and 16 oz. Copper, and as recommended by Copper Development Association handbook or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Base Flashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).

C. Counterflashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).

D. Equipment Support Flashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).

E. Roof-Penetration Flashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).

2.5 WOOD PRODUCTS

A. Lumber: DOC PS20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

B. Preservative Treatment by Pressure Process: AWPA C2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
4. Application: Treat all rough carpentry, unless otherwise indicated.

    a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

C. Fire-retardant coated wood: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use exterior type for exterior locations and where indicated.
2. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
3. Application: Treat all rough carpentry, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and The Copper Development Association's "Copper in Architecture" handbook. Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Cleats: Provide cleats in all flat locked seams at no more than 12 inches on center, but with not less than two cleats per seam. Fasten each cleat to substrate with two copper roofing nails.

F. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

G. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Secure in a waterproof manner. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

H. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

I. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:

1. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07620

SECTION 07840 - FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping in fire rated construction.

B. Through-penetration smoke-stopping in smoke partitions.

1.2 RELATED SECTIONS

A. Sleeves and plates: Section 15052.

B. Ductwork: Section 15815.

C. Fire dampers: Section 15820.

D. Smoke dampers and combination fire/smoke dampers: Section 15901 and 15903.

E. Conduit: Section 16131.

1.3 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory
2. UL 1479: Through Penetration Firestops.

B. American Society for Testing and Materials Standards:

1. ASTM E 814: Standard Test Method For Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

C. Construction gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floor or roof decks; and gaps between adjacent sections of structural floors.

D. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

E. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

F. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

G. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.

1.5 SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.
2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.6 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

C. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.
2. Manufacturer or manufacturer's representative shall provide qualified engineering judgements and drawings relating to conditions where rated assemblies do not exist.

D. Quality control submittals: Evidence of installer's qualifications

E. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.7 QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Installer's qualification: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.
2. Successfully completed at least 5 comparable scale projects using these systems.

C. Obtain acceptance from the Architect for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

D. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 1, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance,

migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Provide systems or devices listed by rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance and that the system be symmetrical for wall applications. Systems or devices shall be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the rated system or device, and designed to perform this function.

2.2 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.3 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency and in accordance with manufacturer's instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as specified for firestopping.

D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of pipes, ducts, conduits, cables, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application.

3.4 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.5 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

END OF SECTION 07840

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Field painting of exposed bare and covered pipes and ducts (including color coding as required in Section 15050, Basic Mechanical Materials and Methods), and of hangers, exposed steel and iron work, and primed (not finished) metal surfaces of equipment installed under mechanical and electrical specifications.
2. As described in Division 1 Sections "Summary" and "Cutting and Patching," Architect will paint building finished surfaces.

B. Do not paint:

1. Steel supports of temporary air-handling units specified in Section 15722.
2. Pre-finished items, for which factory finish or installer finishing is specified or selected, except for touch-up.
3. Materials with integral color finish, such as anodized aluminum, stainless steel, chromium plate, copper or bronze, acoustical tile, or integrally colored plaster.
4. Concealed surfaces: Walls or ceilings in concealed or generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, elevator shafts, and surfaces behind fixed furniture and casework, except as specified above to be primed.
5. Operating parts.
6. Code-required labels and equipment identification, performance rating, name, or nomenclature plates.

1.2 SUBMITTALS

A. Product data: For each product, submit manufacturer's technical information. For paints, include analysis of contents by volume for major pigment and vehicle materials and proportions. Include application instructions.

B. Shop drawings: Submit a complete schedule of all paint materials proposed for use, in the same format as the schedule included as part of this section.

1.3 QUALITY ASSURANCE

A. Source and compatibility: Provide primers and undercoats produced or recommended by manufacturer of finish coats. Use only thinners approved by manufacturer, within recommended limits.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Labels: Label each container with:

1. Manufacturer's name.
2. Name of material.
3. Manufacturer's stock number and date of manufacture.
4. Fed. Spec. number, if applicable.
5. Instructions for mixing and reducing.
6. Color name and number.

B. Storage and protection:

1. Keep from freezing.
2. Maintain containers tightly covered and protected from foreign materials.

1.5 PROJECT CONDITIONS

A. Temperatures: Apply water-based paints only when temperatures of surfaces and surrounding air are between 50 and 90 degrees F. Apply oil-based paints only when temperatures are between 45 and 95 degrees F. Apply varnishes when temperatures are at least 65 degrees F.

B. Humidity: Do not paint in snow, rain, fog, or mist, or when relative humidity exceeds 85 per cent, or on damp or wet surfaces.

1. Painting may continue during inclement weather if areas and surfaces are enclosed, ventilated, and heated or cooled within limits specified, for 24 hours before, during, and 48 hours after application and drying, except as otherwise required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include but are not limited to, products listed in the paint schedules.

2.2 MATERIALS

A. Scheduled products:

1. The scheduled products are intended to set a standard for the type of system, composition of the paints, and for performance. Proposed products must meet or exceed this standard in every category.
2. Provide ready mixed to the project site.

B. Lead content: If lead is present in pigment, it is to constitute not more than 0.06 per cent as lead metal, of the total dry-film weight.

C. Accessory materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically listed but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES: Systems are scheduled at the end of Part 3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection: Examine areas and surfaces where painting work will be done. Do not begin until site conditions meet this specification and requirements for a satisfactory application.

B. Conditions: Do not paint over dirt, scale, rust, grease, moisture, scuffed surfaces, or other detrimental conditions.

3.2 PREPARATION

A. General:

1. Follow manufacturer's instructions and specified requirements for each type of surface.
2. Provide barrier coats over incompatible primers, or remove and reprime.
3. Special care is required to protect furnished, occupied rooms. See Division 1 Section "Temporary Facilities and Control."
4. Touch up shop-applied prime coats wherever damaged or bare. Sand hard, glossy prime coats to provide bonding for finish coats.

B. Ferrous metals: Use solvent or mechanical cleaning.

C. Galvanized metals: Clean with non-petroleum-based solvent.

3.3 PREPARING MATERIALS

A. Manufacturer's directions: Follow manufacturer's printed instructions.

B. Containers: Maintain clean and free of foreign materials or paint residue.

C. Mixture: Stir before beginning and during application to maintain uniform density. If surface film should form, do not mix it into material but remove it and strain paint, if necessary, before proceeding.

D. Thinning: Do not thin paints with solvents which have been used to clean brushes and equipment.

3.4 APPLICATION

A. General:

1. Follow manufacturer's printed instructions.
2. Apply additional coats when undercoats or other conditions show through final coat.
3. Assure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equal to that on flat surfaces.
4. Paint backs of access panels and removable or hinged covers to match exposed surface.
5. Between coats of enamels and varnishes, sand lightly.
6. Allow sufficient time between coats for proper drying. Do not apply succeeding coat until underlying coats have dried or cured completely.
7. Apply materials at manufacturer's recommended rate to achieve minimum dry film thickness recommended or specified.

B. Mechanical and electrical work:

1. See requirements of Sections 15050 and 16050.
2. Mechanical work to be painted includes but is not limited to:

   a. Piping, duct hangers, and supports.
   b. Ductwork and insulation. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

3. Electrical work to be painted includes, but is not limited to:

   a. Conduit and fittings.

C. Completed work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work not complying with specified requirements.

3.5 CLEANING AND PROTECTION

A. Cleaning:

1. During progress of work, remove from site discarded materials, rubbish, and rags at the end of each work day.
2. On completing work in each area, clean all surfaces spattered with paint. Do not damage finished surfaces.

B. Protection: Protect surrounding work whether to be painted or not. Remove any protective wrappings after completion of painting. At completion of all work, return and touch up and restore all damaged painted surfaces.

3.6 SCHEDULE: INTERIOR SURFACES

A. Ferrous metal: Provide the following systems over ferrous metal.

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

b. Undercoat: Alkyd, interior enamel undercoat or full-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

B. Zinc-coated Metal: Provide the following system over zinc-coated metal:

1. Full-Gloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils0.031 mm.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

c. Finish Coat: Full-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

3.7 SCHEDULE: EXTERIOR SURFACES

A. Ferrous metal:

1. Full-gloss alkyd-enamel finish: 2 finish coats over a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

b. Finish coats: Full-gloss, alkyd exterior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2 mils (0.051 mm).

END OF SECTION 09900

SECTION 10210 - WALL LOUVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Louvers and equipment screen as indicated on the drawings.

1.2 RELATED SECTIONS

A. Ductwork: Section 15810.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Louvers and equipment screens.

C. Samples: For finish selection, manufacturer's complete line of color chips.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Provide louvers with free area, pressure drop, and water penetration as published in manufacturer's literature for the specified model, tested in accordance with AMCA Standard 500.

1. Louvers greater than 12 inches in height: With adjustable-width sill, four inches deep.
2. Louvers 12 inches or less in height: Model with adjustable-width sill, two inches deep.

B. Construction: 0.081 inch thick extruded aluminum stormproof sections, one-piece extruded aluminum jamb, head and sill sections, flanged frame, and sill with adjustable sill extension. Blade lengths shall not exceed four feet. For louvers more than four feet wide, provide vertical mullions, evenly spaced.

C. Bird screen: ASTM E 437, general industrial-use wire cloth, Grade C, medium light or heavier, nominal half-inch mesh and 0.063-inch wire diameter, aluminum, in removable frame.

D. Accessories: Angles, moldings, cover plates, anchor bolts, and other items required for securing louvers in openings as detailed on the drawings, aluminum or stainless steel. Exposed accessories shall be finished to match the louvers.

E. Sizes: Shown on drawings.

F. Finish: Manufacturer's standard factory-applied baked enamel or fluoropolymer finish, color to be selected.

2.2 BLANK-OFF PANELS

A. Laminated metal-faced panels, 2 inches thick, with aluminum facing sheets front and back 0.032 inches thick, and rigid fiberglass insulation.

B. Finish: Same as louvers, except that color shall be black.

2.3 EQUIPMENT SCREEN

A. Vertical equipment screen with 20 to 32 percent free area; 4-inch-deep chevron blades; 0.081-inch-thick aluminum; color to be selected from manufacturer's full range. Screen installed over structural steel framing; incorporating horizontal subgirts at spacing appropriate to wind load requirements.

PART 3 - EXECUTION

3.1 INSTALLING LOUVERS

A. Place each louver plumb, level, and in alignment with adjacent work.

B. Use concealed anchorage where possible. Provide brass or lead washers on screws where required to protect metal surface and to make weathertight connections.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Install concealed gaskets, flashings, joint fillers, and insulation where required to make louvers weathertight.

E. Blank off any section of louver not required to be open.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction period so that no evidence remains of correction work.

B. Clean and touch up minor abrasions in finishes with air-dried coating matching color and gloss of, and compatible with, factory-applied finish.

END OF SECTION 10210

SECTION 10605 - WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Manufactured wire mesh partitions.

B. Hinged door with cylinder lock.

1.3 SUBMITTALS

A. General: Comply with Division 01 Section "General Requirements."

B. Product data:

1. Each component included in the work.
2. Manufacturer's detailed installation instructions.

C. Shop drawings: Plans, elevations, and details of actual installation.

D. Operating and maintenance data: Include installation instructions. Wire mesh systems may be reconfigured, moved, or added to in the future.

PART 2 - PRODUCTS

2.1 WIRE MESH PARTITIONS

A. Shop-fabricated partitions of wire mesh fastened to channel framing, with hinged door, Standard Duty in accordance with standards of the Woven Wire Products Association, 10 feet high, stock panel widths except as filler panels are required to complete the installation as shown on the drawings.

B. Mesh: Woven wire, 10 gauge (0.135 inch) in 1.5-inch diamond pattern.

C. Vertical framing members: 1.25 by 0.625-inch cold-rolled steel C channel.

D. Corner posts: 1.25 by 1.25-inch steel angles.

E. Horizontal framing members: 1 by 0.5-inch cold-rolled steel channels.

F. Center reinforcing bar: Two 1 by 0.375 by 0.125-inch steel channels riveted through mesh, 3.5 feet from floor.

G. Top capping bar: 2.25 by 1-inch cold-rolled steel channel.

H. Joints: Mortise and tenon.

I. Floor sockets: Cast aluminum.

J. Door: Same construction as partition with flat bar cover all 4 sides, width and hand shown on drawings; hinged on 1-1/2 pair butts riveted to both door and frame; key-operated mortise cylinder lock on outside and recessed knob inside.

1. Lock cylinder shall match Government's master key system.

K. Hardware and fasteners: Provide wall clamps, bolts, and other accessories required to install the configuration shown on drawings.

L. Finish: Manufacturer's standard enamel, gray.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's installation instructions.

B. Ensure that partitions are level, plumb, and parallel to building structure.

C. Adjust door and hardware to ensure that door swings freely and lock operates properly.

END OF SECTION

SECTION 13281 - ASBESTOS ABATEMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY:

A. This section includes the removal and disposal of any asbestos containing materials generated by the work.

B. Related sections include the following:

1. Section 01732 Selective Demolition.
2. Section 13282 Lead Abatement.

C. Coordinate the removal of asbestos containing materials with the related sections noted above.

1.2 DESCRIPTION OF WORK:

A. General: This section includes required procedures necessary to reduce air concentrations of asbestos to the specified level and maintain the specified asbestos control limits that is mandated during the life of the contract. It also includes procedures for the removal, containment, and disposal of asbestos containing materials. It also includes procedures for lock down encapsulate.

1. Work Area: The work areas includes the following: See Contract Drawings.
2. The following are insulated with asbestos-containing materials which are to be disturbed and removed:

Material or Surface	Space or Area
Air handling unit casings, fans, and plenums	7th Floor - Mechanical Room
Air handling unit ductwork	7th Floor - Mechanical Room
Air handling unit chilled water piping	7th Floor - Mechanical Room
Air handling unit steam and return piping	7th Floor - Mechanical Room
Steam and return piping	Sub Basement Mechanical Room

3. The asbestos work includes the demolition and removal of asbestos piping and fitting insulation, and block or rigid insulation on ductwork and air-handling unit casings indicated for demolition. Asbestos-containing materials not indicated to be

demolished shall remain intact. Refer to demolition specifications and the drawings for sizes and extent of work governed by 40 CFR 763.

1.3 QUALITY ASSURANCE:

A. Definitive Responsibility Criteria:

1. **Qualifications For the Asbestos Abatement Contractor:**

   a. **Asbestos Abatement Experience:** Provide the name and location of at least five (5) prior asbestos abatement projects, successfully performed by the selected Asbestos Abatement Contractor, that are comparable in scope of work, structure, project costs and in complexity. For each project include the name and current telephone number of the project's contract representative. Address how each project is comparable in scope of work, structure, project costs and complexity.

   b. **Project Documents:** Provide copies of the daily logs and air monitoring reports including final clearance sample results, for the five abatement projects submitted in response to the preceding paragraph.

   c. **Pollution Liability Insurance:** Submit proof of Pollution Liability Insurance coverage. If the completion date of the bid project is beyond the effective dates of the Pollution Liability Insurance coverage, then the selected contractor shall submit a statement stating it is understood, that this Pollution Liability Insurance coverage, shall remain in effect throughout the duration of this contract.

   d. **Federal/State EPA and OSHA citations**: Provide a list all federal and State EPA or OSHA citations the Contractor has received in the last five (5) years.

2. **Qualifications for the Supervisor / Competent Person:** Provide the name and experience record of the proposed Supervisor/Competent Person and foreman, the selected Asbestos Abatement Contractor, will assign to this project. Provide evidence that the proposed Supervisor/Competent Person has supervised at least five (5) asbestos abatement contracts of comparable scope and complexity.

   a. **Accreditation:** Provide evidence that shows the proposed Supervisor/Competent Person, is accredited as an asbestos Contractor/Supervisor as described in 40 CFR Part 763 (EPA's Model Accreditation Plan).

3. **Qualifications for the Certified Industrial Hygienist (CIH):** Provide the name and experience record of the CIH selected to perform the duties outlined in "Project Certified Industrial Hygienist" below. Provide evidence showing that, in the last five years, the selected CIH has performed abatement oversight on projects of comparable scope and complexity.

   a. **Certification, Accreditation and Training:** Provide evidence that shows the selected CIH (1.) is certified in Comprehensive Practice by the

American Board of Industrial Hygiene (ABIH) (2.) is currently accredited as an Asbestos Building Inspector, Contractor/Supervisor, and Project Designer as described in 40 CFR Part 763 (3.) has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course *Sampling and Evaluating Airborne Asbestos Dust* or equivalent (4.) is currently registered in the American Industrial Hygiene Association's (AIHA) *Asbestos Analytical Registry* (5.) is currently participating in their *Proficiency Analytical Testing* (PAT) certification program.

b. **Errors and Omissions Insurance:** Provide evidence showing the Project CIH has Errors and Omissions Insurance coverage. If the completion date of the project is beyond the effective dates of the insurance coverage, submit documentation stating that the CIH(s) Errors and Omissions Insurance coverage will be kept current and in effect for the duration of the project.

4. **Qualifications for the Industrial Hygienist (IH):** Name of and experience record of the Industrial Hygienist(s) (IH) , the CIH selects, who are qualified by virtue of their training and work experiences, to perform duties assigned by the CIH. Show experience on 5 projects of comparable scope and complexity, that the IH has overseen in the last five years. Provide evidence that:

   a. The selected IH is currently Accredited as an asbestos building inspector, Contractor/Supervisor, and Project Designer as described in 40 CFR Part 763.
   b. The selected IH has successfully completed the NIOSH 582 course Sampling and Evaluating Airborne Asbestos Dust or equivalent and is currently registered in the American Industrial Hygiene Association's (AIHA) Asbestos Analytical Registry.
   c. The selected IH is currently participating in their (PAT) certification program.

5. **Testing Laboratory Qualifications:** Proof of qualifications of testing laboratory and personnel as follows:

   a. **Accreditation:** Provide proof of accreditation by the AIHA for asbestos analysis, and the NIST under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis.
   b. **Proficiency:** Provide the two most recent consecutive quarterly reports showing the laboratory analyzing the samples has been judged proficient by successful participation in the NIOSH's PAT certification and Bulk Asbestos Proficiency Analytical Testing (ELPAT) programs.
   c. **Laboratories and Microscopists:** Provide proof the laboratory(s) selected to analyze project samples is accredited by the American Industrial Hygiene Association (AIHA), holds appropriate state license and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. For microscopists to analyze fibers-in-air samples on site, provide proof that they have been judge by current inclusion on the AIHA Asbestos Analyst's Registry (AAR).

d. **Errors and Omissions Insurance:** Provide evidence showing the laboratory has Errors and Omissions Insurance coverage. If the completion date of the project is beyond the effective dates of the insurance coverage, submit documentation stating that the laboratory's Errors and Omissions Insurance coverage will be kept current and in effect for the duration of the project.

B. **Contractors performing** asbestos abatement work for the Architect of the Capitol in the District of Columbia are required to be licensed to do asbestos work in the District of Columbia. The Contractor shall comply with the licensing regulations of:

Government of the District of Columbia
Department of Consumer and Regulatory Affairs (DCA)
Environmental Regulation Administration
51 N Street NE
5th Floor
Washington, DC 20002

C. **Contractor employees** assigned to active asbestos work areas in the District of Columbia must be licensed by the District of Columbia as trained asbestos workers and supervisors. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker/supervisor course; have training on the standard operating procedures of the Abatement Contractor; have one year of asbestos abatement experience; have applicable medical and respiratory protection documentation; have certificate of training and State accreditation/license.

D. **Asbestos Control Limits:** The enclosed work areas shall be defined as a regulated area in accordance with 29 CFR 1910.1001 and 29 CFR 1926.1101.

1. **Inside Asbestos Work Area:** For personnel wearing negative-pressure respirators, air concentrations of asbestos shall not exceed an 8-hour time weighted average of 0.1 fibers (longer than 5 microns), per cubic centimeter of air as determined by the NIOSH 7400 method. Regardless of respiratory protection worn, air concentrations inside the work area will not exceed an 8-hour time weighted average of one (1) fiber per cubic centimeter as determined by the NIOSH 7400 method. In the event that this level is exceeded, all work in the asbestos work area shall stop and may not restart until fiber levels are below an 8-hour time weighted average of one (1) fiber per cubic centimeter as determined by the NIOSH 7400 method. It is the responsibility of the Contractor to provide an independent industrial hygiene consultant to provide the required personal air monitoring and to assure that all safety and health procedures are followed.
2. **Outside Asbestos Work Area:** Air concentrations of asbestos shall not exceed 0.01 fibers (longer than 5 microns) per cubic centimeter of air as determined by the NIOSH 7400 method. This applies to all areas in the building while work is in progress, except for the asbestos work area. Anytime this level is exceeded, all work in the asbestos work area will be stopped and may not restart until approval from the AOC/SOHB is given. To assure compliance with this provision, the government may provide (in addition to the approved sampling plan), air monitoring outside the

Contractor's work area. If used, the government's industrial hygienist will have unrestricted access to the Contractor's work site. If the asbestos abatement Contractor wishes, he may perform any additional air sampling to assure compliance and for comparison with this specification.

E. **Project Certified Industrial Hygienist (Project CIH):** The primary Contractor shall engage the services of a CIH certified in Comprehensive Practice by the American Board of Industrial Hygiene (ABIH) for the period of this contract. Selection of the Project CIH is subject to approval of the Architect. This person is responsible for all environmental oversight of this contract. Although contracted by the General Contractor, the Project CIH is responsive to the Architect. During the contract period, the Project CIH is required to be on call and to be on project site within two hours after notification by the Architect. Additionally, the Project CIH will arrange for another Architect approved CIH, to be a back-up, to cover duties assigned under this specification, in the event that the selected Project CIH is not able to be on site as required or cannot report to the project site within the allotted 2 hours. Responsibilities for the Project CIH include but shall not be limited to the following:

1. **Coordination meeting.** Immediately after selection the Project CIH will contact the Architect to schedule a coordination meeting. Suggested attendees to this meeting are: the AOC Construction Manager, a representative of the AOC/SOHB, and a representative of the AOC jurisdiction where the work is being performed. The purpose of this coordination meeting is to establish a clear working knowledge of the project and the responsibilities of the Project CIH with the Architect's staff.
2. **Certify**, that prior to beginning any abatement activity, all personnel is trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Provide copies of the initial training certificates and all refresher taken to date.
3. **Certify** that medical examinations meeting the requirements of 29 CFR 1926.1101 (m) are provided for all personnel working in the regulated area, regardless of exposure levels. The physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the opinion the person has been evaluated for working in a heat stress environment while wearing personal protective equipment and is able to perform the work.
4. **Review,** approve and submit for review to the Architect:

   a. **All asbestos abatement plans** of action for conformance to applicable referenced standards and this specification.
   b. **All submittals** (except initial submittal of contractor qualification information) the Contractor submits under paragraph 1.4.
   c. **All sampling data** within the time frames outlined in this specification.

5. **Review,** approve and submit to the Architect for review all required Material Safety Data Sheets (MSDS) submitted by the Contractor.

6. **Inspect and or oversee** the inspection of, asbestos abatement removal work for conformance with the approved plan.
7. **Develop and submit** for review a daily monitoring plan to test airborne levels of asbestos to determine exposure levels. The plan will include all personal, area, and final air samples to be used to clear a containment area.
8. **Perform daily monitoring** in accordance with the approved plan.
9. **Ensure all work** is performed in strict accordance with this specification at all times.
10. **Ensure hazardous exposure** to personnel and to the environment are adequately controlled at all times.
11. **The Project CIH shall visually inspect** and approve all asbestos containment areas before asbestos containing materials are removed and before performing any final air tests.
12. **At the direction** of the AOC/SOHB, the Project CIH shall investigate possible contaminations and contamination related complaints. The Project CIH, shall perform any necessary sampling and/or site investigations in order to develop findings and conclusions of the reported incidence. Submit a verbal report that outlines all findings of the investigation to the AOC/SOHB within 24 hours of the initial notice. Submit a final written report to the AOC/SOHB within 3 work days of the initial notice.
13. **With the approval of the Architect the Project CIH** may select IH (s) to perform duties assigned by the Project CIH. The selected IH (s) shall be under the direct supervision of the Project CIH, who will be responsible for IH(s) job performance, and will review and approve all results of their work. The selection of IH (s) shall be based on their training and work experiences and will be subject to the approval of the Architect.
14. **PPE:** Establish the Personal Protective Equipment (PPE) daily.

F. **Project Competent Person**: The abatement contractor shall assign a competent person as defined in 29 CFR 1926.1101, as a person who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate them. This person shall meet the criteria outlined in paragraph 1.2.A.2, of this specification and is required to be on site supervising the work. Responsibilities for the Project Competent Person include but shall not be limited to the following:

1. Comply with the requirements outlined in 29 CFR 1926.1101, paragraph (o) *Competent Person.*
2. Follow the requirements outlined by the Project CIH.
3. Limit access to the abatement area by permitting only authorized personnel and personnel listed in "Access to Work Area" below to enter.
4. No employee shall be allowed to wear a respirator unless a physician has determined they are capable of doing so and has issued a written opinion for that person.
5. All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Fit tests shall be done for PAPRs with the blower off.

6. The Competent Person shall assure that the positive/negative fit check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective face piece to face seal as evidenced by failure of a fit check shall preclude that person from wearing a respirator until resolution of the problem.
7. Maintain a daily log of all persons who enter and exit the work area until the containment is authorized for removal.
8. Working with the project CIH, ensure that all documents are filed in the final report due three days after the containment is authorized for removal.
9. Ensure that only personnel with current EPA accreditation and DC asbestos license, perform abatement work in the work area.

1.4 REFERENCES:

A. American National Standards Institute (ANSI) Publication:

1. Z9.2-79 - Fundamentals Governing the Design and Operation of Local Exhaust Systems

B. American Society for Testing and Materials (ASTM) Publication:

1. E 849-82 - Safety and Health Requirements relating to Occupational Exposure to Asbestos

C. Code of Federal Regulations (CFR):

1. 29 CFR 1910.1001, Occupational Safety and Health Act (OSHA), INCLUDING Appendix A through I.
2. 29 CFR 1910.20, Subpart C, General Safety and Health Provisions.
3. 29 CFR 1910.134, OSHA General Industry Respirator Requirements.
4. 29 CFR 1926.1101. Occupational Exposure to Asbestos, Construction Industry Standard, INCLUDING Appendix A through K.
5 40 CFR Part 61, Subpart M: U.S. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants (NESHAP) Asbestos.

D. State and Local Regulations:

1. Applicable state and local regulations shall apply.

E. Architect of the Capitol

1. The Architect of the Capitol's *Uniform Asbestos Management Program.*
2. Other special requirements listed by the AOC.

1.5 SUBMITTALS:

A. **General:** Transmit all submittals to the Architect for review.

B. **Initial Submittal of Asbestos Abatement Contractor or Subcontractor Qualification Information:** Items 1 through 3 below are to be submitted as a complete package after the bid receipt, but are required to be reviewed by the AOC Safety and Environmental Division (AOC/SOHB) prior to Notice to Proceed.

1. **Asbestos Abatement Contractor or Subcontractor Qualification Information:** Submit for review, the name, address, telephone number and required documentation of qualifications of the Asbestos Abatement Contractor or Subcontractor, selected for this contract.
2. **Certified Industrial Hygienist (Project CIH):** Submit name, address, telephone number and required documentation of qualifications of the Certified Industrial Hygienist selected to perform the duties outlined in "Project Competent Person"above.
3. **Experience and Qualifications of Supervision:** Submit name of and required documentation of qualifications of the proposed competent person who would be assigned to this project, as outlined in "Definitive Responsibility Criteria" above.

C. **Post-Award Asbestos Abatement Submittal:** Items listed below are to be submitted after the award, but are required to be reviewed and recommended approved, by the Project Certified Industrial Hygienist (CIH) prior to submission to the Safety and Occupational Health Branch or his designated representative. These actions must be completed prior to starting work.

1. **Experience and Qualifications of Workers:** Name and experience record, if any, of workmen who will be assigned to this project. Include for each person evidence of successful completion of State of Maryland or Commonwealth of Virginia training given by qualified personnel. Provide certification that employees meet the OSHA medical surveillance requirements.
2. **License Information:** Provide a copy of a current District of Columbia Asbestos Contractor's License and Individual Asbestos License for asbestos projects in the District of Columbia.
3. **CIH Approved Plan of Action:** Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of, and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:

   a. Manufacturer's information on the negative air machine(s).
   b. Method of supplying power to the units and designation/location of the panels.
   c. Description of testing method(s) for correct air volume and pressure differential.
   d. Provide manufacturer's product data on the pressure differential measuring device used.

   There will be 4 air exchanges required with minus 0.02 inch of water pressure differential. The plan must include the location and layout of each containment and

decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site. The plan must explain the use of portable HEPA ventilation systems, identify the means of isolating the building's HVAC system during removal operations, detail the method of removal to prohibit emissions into the work area, and identify the method of packaging the asbestos waste. No locally exhausted HEPA filtered drills or saws shall be used as the sole means of containment of drilling or cutting asbestos-containing materials unless prior approval is given by the AOC/SOHB.

4. **Project CIH Approved Area Sampling Plan:** Submit a detailed plan which shows the proposed air sampling strategy to be used to comply with the requirements specified. This plan must be separate from the CIH approved plan of action. Show all locations where sampling will occur during the asbestos abatement operation.
5. **Temporary Storage of Containerized Asbestos Waste:** Submit a request to the AOC, requesting a location for temporary storage of containerized asbestos waste that is generated by this project.
6. **Project CIH Approved Disposal Plan:** Submit to the Architect a disposal plan including the location of the approved disposal site and the contractor's method for documenting proper asbestos disposal. Detail the methods by which the containerized asbestos waste is taken from the work area to the temporary storage area.
7. **IH qualifications:** Submit the name and required documentation of qualifications of the proposed IH (s)for this project.
8. **NESHAP Notification Requirements**: The contractor shall coordinate with the AOC/SOHB, in submitting the appropriate written notification. Any costs incurred due to expiration of the EPA NESHAP notice before completing assigned abatement work will be at the expense of the Contractor. **For the purpose of this contract, initial and all changes to the initial notification shall be postmarked by the appropriate addressee below, at least** 10 working days and 35 calendar days respectively, prior to the start of asbestos abatement work:

   a. Ten (10) working days prior to beginning asbestos abatement work notify:

      U. S. Environmental Protection Agency Region III
      Pesticides/Asbestos
      Programs and Enforcement Branch
      Mail Code: 3WC32
      1650 Arch Street
      Philadelphia, PA 19107

      And

      District of Columbia
      Department of Health
      Air Quality Division
      51 N Street NE
      Washington, DC 20002

Phone: (202) 535-2259
FAX Number 202-535-1371

Thirty Five (35) days prior to beginning asbestos abatement work notify:

AOC, Safety and Occupational Health Branch (AOC/SOHB)
Ford House Office Building
Room HOB2-553
Washington DC 20515
Phone: (202) 225-4043
FAX NUMBER (202) 226-9915

And the affected AOC Building Superintendent to satisfy the District of Columbia's building occupant asbestos abatement notification requirement.

b. **Changes to the original NESHAP Notification:** Any changes to the original notification, shall be coordinated with the AOC/SOHB prior to submission. After this coordination, the Contractor shall submit changes to the original notification, pursuant to the NESHAP requirements, within the time frames specified and to the appropriate jurisdiction listed above.

c. **Emergency NESHAP Notices:** The Contractor, shall contact the AOC/SOHB, for procedures regarding the submission of any emergency notifications, pursuant to the NESHAP requirements.

9. **AOC Asbestos Project Number:** Contact the AOC/SOHB at 202-225-4043 for this number. This Asbestos Control Number will be used in all documents concerning this project.
10. **Certificates of Compliance:** RESERVED
11. **Information on Encapsulating Material:** Submit written evidence that material meets the the specified characteristics and the latest requirements of the EPA.
12. **Laboratory Qualification Information:** Submit proof of required qualifications of testing laboratory and their personnel. See "Testing Laboratory Qualifications".
13. **Containers For Disposal of Friable Asbestos:** Submit for review, the manufacturers cut sheet for the bags and containers the contractor intends to use to dispose of the asbestos containing material. Bags shall be minimum of 6 mil polyethylene (or equivalent) and labeled in accordance with 40 CFR Part 61 subpart M (NESHAP) and 29 CFR 1926.1101.
14. **Decontamination Facility:** Unless otherwise specified by the AOC/SOHB, throughout the time that asbestos abatement is taking place, the Asbestos Abatement Contractor will maintain a working three-stage decontamination facility at the point of access to the containment. As a minimum, the decontamination facility will consist of a clean changing area, an air space, a shower, another air space, and a contaminated changing area. The size and location of this facility shall be reviewed by the AOC/SOHB.
15. **Sequencing/Scheduling:** Submit for review, the sequencing and/or scheduling for each containment or containments being performed under this contract, to the AOC/SOHB.

16. **Filtering for vacuums and exhaust equipment** shall conform to ANSI Z9.2. HEPA filters shall be used in all vacuums and exhaust equipment. All HEPA filtered vacuums and exhaust equipment shall be tested for integrity with a Dioctylphthalate (DOP) or Dioctylsubacate (DOS) smoke generator. Submit evidence showing that all HEPA filtered vacuums and exhaust equipment, scheduled for use under this Contract, have been tested and passed an DOP or DOS smoke generator.
17. **HEPA Filter Replacement:** If any HEPA filtered vacuums or ventilation equipment requires HEPA filter replacement during this abatement operation, another dioctylpthalate (DOP) test shall be performed. The results of the dioctylpthalate (DOP) test shall be submitted when received and reviewed by the AOC/SOHB before re-using the equipment under this Contract.
18. **Encapsulant Requirements:** Submit, before the start of work, the manufacturer's technical data for all types of encapsulant used on the project. Provide application instructions. Submit certification data as required in Encapsulant section. Submit MSDS for each material in compliance with 29 CFR 1910.1200. Submit certification from manufacturer that material it will adequately wet ACM as per NESHAP requirements.

D. **During-Work Asbestos Abatement Submittal:** After review and approval by the Project CIH, submit items required under 1.4D1 and 1.4D2 to the AOC/SOHB as the work progresses and at the times specified.

1. **Air Monitoring and Work Area Inspections:**

   a. **Air Monitoring Results:** Post for all workers to see, within 24 hours of collection, the results of all air monitoring conducted. Post the results at a location designated by the General Contractor and notify the AOC/SOHB. A copy of the results shall be provided to the AOC/SOHB within the same time frame.
   b. **Differential Air Pressure Readings:** Starting when a negative pressure containment is erected and approved by the Project CIH, a strip chart recorder shall be installed and work area relative pressure shall be monitored 24 hours a day until final air clearances are produced. Submit a copy of the daily strip chart record to the AOC/SOHB within 24 hours after the recording was made.
   c. **Work Area Inspections:** The Project CIH shall personally perform a visual inspection of the abatement work area for the pre-removal, pre-final, and re-occupancy stage. The Project CIH or the IH(s) working for the Project CIH, will perform visual inspections of the abatement work area daily and pre-final. Submit documentation of the daily, pre-removal, pre-final inspections to the AOC/SOHB, within 24 hours of completion. Documentation of the re-occupancy stages of the work inspection shall be submitted to the AOC/SOHB as soon as completed.

2. **Transporting and Disposing of Asbestos Containing Materials (ACM):**

a. **Disposal Receipts:** Submit receipts from the transporter, that acknowledge the contractor's shipment of ACM from the site (NESHAP Waste Shipment Records) within three (3) days following removal of ACM from the premises. Provide on each receipt the date, quantity of material removed, and signature of an authorized representative of the transporter. A signed and dated copy to the Waste Shipment Record, showing receipt at an authorized landfill, must be received by AOC/SOHB within 10 calendar days of the date of the shipping receipt.

b. **Transportation Vehicles:** Transportation shall be in vehicles dedicated to asbestos transportation. Vehicles shall be marked in accordance with DOT and NESHAP regulations.

E. **Final Submittal:** After review and approval by the Project CIH, submit items required under 1 and 2 below to the AOC/SOHB within 3 calendar days at the completion of work for each containment. The CIH shall submit a project report consisting of:

1. The daily log book information and documentation of events during the abatement project.
2. Copies of all waste shipment records for asbestos waste sent to the designated landfill.
3. The report shall include a certificate of completion.
4. All air and bulk sampling conducted for this project.
5. All final air clearance data.
6. All perimeter samples.
7. Copies of training certificates for all personnel engaged in this abatement work.
8. Copies of respirator fit tests for all personnel engaged in this abatement work.
9. Copies of the OSHA required asbestos and respirator medical clearances for all personnel engaged in this abatement work.
10. The final report shall include an executive summary. The executive summary must show:

    a. A summary of the work done.
    b. A statement that all personnel conducting this abatement operation had all required training and were medically cleared to perform this type of work in accordance with OSHA, EPA regulations and all State and Local laws, rules and regulations.
    c. The executive summary must also show that all final air samples results were below the limits established by EPA, the District of Columbia, and this specification and declare the area ready for re-occupancy.
    d. Describe the type, application, and quantity of asbestos containing materials removed by the contractor.
    e. Include all copies of the final air and bulk sampling as performed by a third party.
    f. Indicate that all building systems disturbed by the contractor during the work under the contract have been reinstalled and are in working order.

1.6 CONTRACTOR RESPONSIBILITY:

A. **The Contractor** shall assume full responsibility and liability for compliance with all applicable Federal, State, and local regulations pertaining to the protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations, and shall hold the government harmless for failure to comply with any applicable safety or health regulation on the part of himself, his employees, or his subcontractors.

B. **The Contractor shall** secure all necessary permits in conjunction with asbestos removal, hauling and disposition and provide timely notification of such actions, as may be required by federal, state, regional, and local authorities. For this project, ensure that notification to the Regional Office of the EPA and the District of Columbia is made, and provide copies of the notification to the AOC/SOHB 10 days prior to the commencement of the work. Provide notification in accordance with 40 CFR 61.22(d)(1).

C. **The Contractor** shall inform the affected building Superintendent and the AOC/SOHB not less than thirty five (35) days prior to commencement of the asbestos abatement, of the health or safety factors that necessitate the asbestos abatement and procedures that will be taken to protect the health, safety, and possessions of the building occupants.

D. **SITE SECURITY**

1. **Regulated area** access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Abatement Contractor's employees, employees of Subcontractors, AOC employees and representatives, State and local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
2. **Entry into** the regulated area by unauthorized individuals shall be reported immediately to the Competent Person.
3. **A log book** shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. **Access to the** regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside, however, they shall be sealed with poly sheeting and taped until needed.
5. **The Abatement Contractor's** Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. Containment shall be locked out when the competent person leaves the site. The entrance to the regulated area requires all entrants to be logged in/out so that only authorized personnel are allowed entrance.
6. **The Abatement Contractor** will have the AOC's assistance in notifying adjacent personnel of the presence, location, and quantity of ACM in the regulated area and enforcement of restricted access by the AOC's employees.

7. **The Abatement Contractor** shall provide plans to secure the regulated area during non-working hours.

E. **EMERGENCY ACTION PLAN AND ARRANGEMENTS**

1. **An Emergency Action Plan** shall be developed by the Abatement Contractor prior to commencing abatement activities and shall be agreed to by the Abatement Contractor and the AOC. The Plan shall meet the requirements of 29 CFR 1910.38 (a);(b).
2. **Emergency procedures shall** be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. **Emergency planning** shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule and layout of regulated area, particularly barriers that may affect response capabilities.
4. **Emergency planning** shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, fiber release episodes, confined spaces, and heat stress illness. Written procedures addressing emergency situations shall be developed. Employees shall be aware of these procedures.
5. **Employees shall** be trained in regulated area/site evacuation procedures in the event of workplace emergencies.

    1. **For non life-threatening** situations - employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
    2. **For life-threatening** injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.

6. **Telephone numbers** of all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. **The Emergency Action Plan** shall provide for a contingency plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Abatement Contractor shall detail procedures to be followed in the event of an incident assuring that work is stopped and wetting is continued until correction of the problem.

1.7 **PROJECT/SITE CONDITIONS:**

A. **Means of Egress:** Establish and maintain emergency and fire exits from the work area.

B. **Environmental Conditions to be Maintained:** Normal environmental conditions (heat, light, air conditioning) must be maintained outside of the work area.

C. **DECONTAMINATION FACILITIES:** Provide each work area with separate personnel decontamination facility (PDF) and equipment decontamination facilities (EDF). Ensure that the PDF is the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the EDF. See OSHA 29 CFR 1926.1101, Appendix F. The size and location of this facility shall be reviewed by the AOC/SOHB.

1. **GENERAL REQUIREMENTS**. All personnel entering or exiting a regulated area shall follow the requirements of 29 CFR 1926.1101 (j)(1) and these specifications. All equipment and materials must exit the regulated area through the EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and EDF must be constructed of a minimum of 2 layers of 6 mil, clear/opaque/black/ white fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 2 layers of 6 mil poly shall also be used to cover the floor under the EDF and PDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weigh sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. Construct a solid barrier on the occupied side(s) to protect the sheeting if the area adjacent to the abatement is occupied,.
2. **TEMPORARY FACILITIES TO THE PDF AND EDF**. The Competent Person shall provide temporary water service connections to the EDF and PDF. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary electric power with ground fault protection and overhead wiring in the EDF and PDF. Provide a sub-panel for all temporary power in the clean room. Provide adequate lighting to maintain a minimum of 50 foot candles in the EDF and PDF. Provide temporary heat to maintain 70 deg F throughout the PDF and EDF except the shower of the PDF shall be maintained at 75 deg F.
3. **PERSONNEL DECONTAMINATION FACILITY (PDF)**. The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.
4. **Clean Room:** The clean room must be visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 2 layers of 6 mil fire retardant poly to provide an air tight room. Provide a minimum of 2 flapped doorways 3 feet wide. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry condition. Shower overflow shall not be allowed into the clean room. All surfaces in the clean room shall be disinfected twice after each shift change. An adequate

supply of disposable towels and disposable protective clothing shall be present in the clean room. Provide up to 2 storage lockers per person. A portable fire extinguisher, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room without clothing or with bathing suits and thoroughly washed. Ensure that females, who are required to enter the regulated area be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male can enter or exit the PDF during her stay in the PDF.

5. **Shower Room**: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the regulated area to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 2 layers of 6 mil fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.

6. **Equipment Room**: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment, reusable footwear and for use as a change station for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made of three layers of 6 mil fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 2 layers of 6 mil fire retardant poly. If the airborne level of asbestos in the regulated area is expected to exceed 0.5 f/cc, add an additional air-lock between the equipment room and the regulated area. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6 mil fire retardant poly per shift change and remove this layer after each shift. Provide a temporary electrical sub-panel in this room to accommodate any power tools and equipment used in the regulated area.

7. **PDF construction shall be:** Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF is minimum of double flaps of 6 mil fire retardant poly.

8. **EQUIPMENT DECONTAMINATION FACILITY (EDF)**. The Competent Person shall provide an EDF consisting of a wash room, and clean room for removal

of equipment and material from the regulated area. Personnel shall not enter or exit the EDF except in the event of an emergency. Clean debris and residue in the EDF daily. All surfaces in the EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The EDF shall consist of the following:

a. **Wash Down Station:** Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.

b. **Wash Room**: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using materials selected and furnished by the Abatement Contractor and 2 layers of 6 mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of two layers of 6 mil fire retardant poly.

c. **Holding Room**: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using materials selected and furnished by the Abatement Contractor and 2 layers of 6 mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of two layers of 6 mil fire retardant poly.

d. **Clean Room:** Provide a clean room to isolate the holding room from the building. Construct the clean room using materials selected and furnished by the Abatement Contractor and 2 layers of 6 mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building. Doorways to the clean room shall be constructed of two layers of 6 mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the EDF clean room and the adjacent areas shall be provided.

e. **EDF construction shall be:** Wash Room leading to a Holding Room followed by a Clean Room leading to the building.

9. **EQUIPMENT DECONTAMINATION PROCEDURES**. At wash down station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the EDF, other than the doorway between the wash down station and the Wash Room. Keep all outside personnel clear of the EDF. Once inside the Wash Room, wet clean the equipment and/or bags. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. These personnel shall wear full protective clothing and appropriate respirators. At no time shall personnel from the clean side be allowed to enter the Wash Room.

D. **Access to Work Area:** Only approved personnel are authorized access to the work area. Once asbestos removal has started, access to the abatement work area by non-approved personnel is not permitted unless authorized by the AOC/SOHB representative, the Project CIH or the competent person. Access to work areas shall always be through decontamination areas. No employee shall be allowed to wear a respirator unless a physician has determined they are capable of doing so and has issued a written opinion for that person. All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Fit tests shall be done for PAPRs with the blower off. The Competent Person shall assure that the positive/negative fit check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective face piece to face seal as evidenced by failure of a fit check shall preclude that person from wearing a respirator until resolution of the problem. The Project CIH shall review work area air samples and make adjustments for the type of respiratory protection required. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator. The following personnel shall have access to work area with the established respiratory protection:

1. The AOC/SOHB will provide a list of AOC employees, who are authorized access to the abatement area.
2. OSHA Inspectors.
3. EPA Inspectors.
4. DC Inspectors.
5. Approved Contractor personnel.

E. **PROTECTIVE CLOTHING**: Provide boots, booties, hard hats, goggles, clothing, respirators and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA in 29 CFR 1910.132 (d). Provide all personnel entering the regulated area with disposable full body coveralls, disposable head covering, and 18 inch boot coverings. The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Provide plastic/rubber disposable gloves for hand protection. Cloth type gloves may be worn under plastic/rubber gloves, but cannot be used alone. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle. The contractor shall provide daily, five sets of protective clothing for use by visiting authorized personnel.

F. **REGULATED AREA ENTRY PROCEDURE**: Worker protection shall meet the most stringent requirement. The Competent Person shall ensure that each time workers enter the regulated area, they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

G. **DECONTAMINATION PROCEDURE - PAPR**: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. **When exiting** the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
2. **Proceed to the** shower with respirator but without clothing or with bathing suit. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid damaging filters while showering. The following procedure is required as a minimum:

    a. **Thoroughly wet** body including hair and face. If using a PAPR, hold blower and battery above head to keep filters dry.
    b. **With respirator** still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator face piece and under the respirator straps.
    c. **Take a deep breath**, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.

3. **Carefully decontaminate** the face piece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) decontaminate battery pack with a damp rag. (Note: THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!).
4. **Shower and** wash body completely with soap and water. Rinse thoroughly.
5. **Rinse shower** room walls and floor to drain prior to exiting.
6. **Proceed from** shower to clean room; dry off and change into street clothes or into new disposable work clothing.

H. **DECONTAMINATION PROCEDURE - AIR PURIFYING, NEGATIVE PRESSURE RESPIRATOR**: The Competent Person shall require all personnel use the following decontamination procedures, as a minimum, whenever leaving the regulated area with a full face, HEPA filtered respirator:

1. **When exiting** the regulated area, remove disposable coveralls and ALL other clothes, disposable head coverings, and disposable foot coverings or boots in the equipment room.
2. **Still wearing** the respirator and completely naked, proceed to the shower, which is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required, as a minimum:

    a. **Thoroughly wet** body from neck down. Wet hair as thoroughly as possible without wetting the respirator filter.
    b. **Take a deep** breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter(s). While still holding breath, remove respirator and hold it away from face before starting to breathe.

3. **Dispose of** wetted filters from respirator.
4. **Carefully decontaminate** respirator face piece and respirator inside and out. (NOTE: THIS IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!).
5. **Shower and wash** body completely with soap and water. Rinse thoroughly.
6. **Rinse shower** room walls and floor to drain prior to exiting.
7. **Proceed from** shower room to clean room and change into street clothes or into new disposable work clothes.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. **General Requirements (All Abatements Projects):** All equipment, including protective clothing and respirators, used in the execution of this contract and provided to visitors to the site, shall be approved by the Project CIH and shall comply with ASTM E 849 and with the applicable Federal, State, and local regulations. Respirators shall conform to the OSHA requirements in 29 CFR 1910.134 and 29 CFR 1926.1101, except that single use and disposable respirators shall not be used. Type of respirators required shall be as specified by the Project CIH. If any air sampling indicates levels above 0.1 fibers per cubic centimeter or "too dirty to count", powered air or supplied air (type C) respirators shall be required during actual removal operations.

Prior to the start of work, the abatement contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CIH has submitted verification to the AOC's representative to this effect.

1. **All materials** shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. **Store all materials** subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated/work area until abatement is completed.
3. **The Abatement Contractor** shall not block or hinder use of buildings by staff and visitors to the AOC in partially occupied buildings by placing materials/equipment in any unauthorized place.
4. **The Competent Person** shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the work site and disposed of properly.
5. **Polyethylene sheeting** for walls in the regulated area shall be a minimum of 6-mil thick. For floors and all other uses, sheeting of at least 6-mil thickness shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. **The method of** attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the AOC and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape or other waterproof tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing

polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions (including the use of amended water).

7. **Polyethylene sheeting** utilized for personnel decontamination facility shall be opaque white or black in color, 6 mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided.
9. **An adequate number** of negative pressure units capable of providing a minimum of 4 air changes per hour in the regulated area while maintaining minus 0.02 inch water column shall be used. Two (2) additional negative pressure units shall be available to replace any malfunctioning unit.
10. **An adequate number** of HEPA vacuums, air sampling pumps and loaded filter cassettes, supplied air system, if used, providing Grade D breathing air with respirators and air lines sufficient for personnel, pressure differential gauge and recording capability shall be provided.
11. **An adequate number** of scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be equipped with ground-fault circuit protection.
12. **Special protection** for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds and falling material).
13. **6 mil disposal** bags for asbestos waste shall be pre-printed with labels and markings as required by OSHA, EPA.
14. **Impermeable asbestos** disposal drums shall be metal or fiberboard with locking ring tops with required OSHA, EPA and DOT labels and markings.
15. **The AOC shall be** provided a copy of the MSDS as required for all hazardous chemicals including encapsulants under OSHA 29 CFR 1910.1200 - Hazard Communication. Methylene chloride shall not be used with any spray adhesive or other product.
16. **DANGER signs**, as many and as required by OSHA 29 CFR 1926.1101(k)(7), shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
17. **Adequate respirators**, disposable protective clothing, hard hats, goggles, gloves and footwear for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a hazard assessment conducted under 29 CFR 1910.132(d).

B. **NEGATIVE PRESSURE FILTRATION SYSTEM**: The Abatement Contractor shall provide enough HEPA negative air machines to completely exchange the regulated area air volume 4 actual times per hour. The Competent Person shall determine the number of units needed for each regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the actual cubic feet per minute (cfm) for each unit to determine the number of units needed to effect 4 air changes per hour and maintain -.02 inches of negative pressure. Provide a standby units in the event of machine failure and/or emergency in an adjacent area.

C. **NEGATIVE AIR MACHINES (HEPA UNITS)**

1. **Negative Air Machine Cabinet:** The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
2. **Negative Air Machine Fan:** The fan rating must provide the air-moving capacity under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
3. **Negative Air Machine Final Filter:** The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 mm dioctylphthalate (DOP) particles. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.
4. **Negative Air Machine Pre-filters:** The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 microns or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 microns or larger. Pre-filters shall be installed either on or in the intake grid of the unit and held in place with a special housing or clamps.
5. **Negative Air Machine Instrumentation:** Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery at that point. The unit must have an elapsed time meter to show total hours of operation.
6. **Negative Air Machine Safety and Warning Devices:** An electrical/ mechanical lockout must be provide to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
7. **Negative Air Machine Electrical:** All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriter's Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

D. **HEPA Vacuums**

1. **All HEPA vacuums:** All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriter's Laboratories (UL). Each unit must be provided with overload protection and the motor and housing must be grounded.

B. **Testing of the HEPA Filtered vacuum HEPA filter:** The vacuum filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the HEPA vacuum housing to form an air tight seal. Each HEPA filtered vacuum shall be individually tested and certified to have an efficiency of not less than 99.97 percent when challenged with 0.3 mm dioctylphthalate (DOP) particles. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

2.2 **ENCAPSULATING MATERIALS:**

A. **TYPES OF Encapsulant:** The following four types of encapsulant must comply with performance requirements as stated in "Performance Requirements":

1. Removal encapsulant - used as a wetting agent to remove ACM.
2. Bridging encapsulant - provides a tough, durable coating on ACM.
3. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (½").
4. Lock down encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. **PERFORMANCE REQUIREMENTS:** Encapsulant shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:

1. General Requirements for all encapsulants:

a. ASTM E84: Flame spread of 25; smoke emission of 50.
b. University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
c. ASTM C732: Accelerated Aging Test; Life Expectancy 20 years.
d. ASTM E96 Permeability: Minimum of 0.4 perms.

2. Bridging/Penetrating Encapsulant:

a. ASTM E736 Cohesion/Adhesion Test: 24 kPa (50 lbs/ft2).
b. ASTM E119 Fire Resistance: 3 hours (Classified by UL for use on fibrous or cementitious fireproofing).

c. ASTM D2794 Gardner Impact Test; Impact Resistance: Minimum 11.5 kg-mm (43 in/lb).

d. ASTM D522 Mandrel Bend Test; Flexibility: No rupture or cracking.

3. Lock down Encapsulant:

a. ASTM E119 Fire resistance: 3 hours (tested with fireproofing over encapsulant applied directly to steel member).

b. ASTM E736 Bond Strength: 48 kPa (100 lbs/sq. ft.) (test compatibility with cementitious and fibrous fireproofing).

c. In certain situations, encapsulant may have to be applied to hot pipes or equipment. The encapsulant shall be able to withstand high temperatures without cracking or off-gassing any noxious vapors during application.

4. **The Project CIH** shall review and recommend approval for all encapsulating materials used under this contract, prior to submitting them to Architect for review, and prior to their use on site. Encapsulating materials (sealants) shall meet the latest requirements of the Environmental Protection Agency (EPA) and shall possess the characteristics outlined in paragraphs "Types of Encapsulant" and "Performance Requirements" above and the following:

a. **Adherence.** The sealant eliminates fiber dispersal by adhering to the fibrous substrate with sufficient penetration to prevent separation of the sealant from the sprayed asbestos material.

b. **Impact Penetration.** It withstands impact and penetration, protects the enclosed sprayed asbestos material, and it must not cause separation of sprayed asbestos material from its original substrate.

c. **Flexibility.** It possesses enough flexibility to accommodate atmospheric changes and settling of the structure over time.

d. **Resistance to Smoke and Flame.** It shall have high flame retardant characteristics and a low toxic fume and smoke emission rating.

e. **Ease of Application.** It must be easily applied with relative insensitivity to errors in preparation or application. Ease of repair by routine maintenance personnel is desirable.

f. **Toxicity.** The sealant must be neither noxious nor toxic to application workers and structure users thereafter.

g. **Permeability.** It should have some permeability to water vapor to prevent condensation accumulation be resistant to common cleaning agents.

h. **Stability.** It shall have suitable stability to weathering and aging.

C **Guarantee.** Guarantee encapsulating materials in accordance with Guarantee clause of the General Conditions.

PART 3 - EXECUTION

3.1 PREPARATION:

A. **ISOLATE THE WORK AREA.** Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment, and supplies from the regulated area before commencing work, or completely cover with two layers of 6-mil fire retardant poly sheeting and secure with duct tape. Lock out and tag out any HVAC systems in the regulated area. Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government. Provide firestopping and identify all fire barrier penetrations.

B. **CRITICAL BARRIERS**: Completely separate the regulated area from adjacent areas using fire retardant poly at least 6 mils thick and duct tape. Individually seal with two layers of 6 mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects or openings in the regulated area. Use care with hot/warm surfaces.

C. **PRIMARY BARRIERS:** Clean all furniture, equipment, etc., with HEPA vacuum and wet cleaning prior to being moved or covered. Clean all surfaces in the regulated area with the HEPA vacuum and wet wiping before installing poly sheeting. Cover the regulated area with two layers of 6 mil fire retardant poly on the floors and two layers of 6 mil fire retardant poly on the walls, unless otherwise directed in writing by the AOC's representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12 inches). Seams must overlap at least 1800 mm (6 feet) and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Mechanically support and seal with duct tape and glue all wall layers.

1. **Stairs and Ramps:** If stairs and ramps are covered with 6 mil plastic, two layers must be used. Provide 19 mm (3/4") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.
2. **Carpeted Floors:** Carpeting shall be covered with three layers of 6 mil poly. Corrugated cardboard sheets or a ridge material approved by the AOC must be placed between the top and middle layers of the poly.
3. **Elevators:** Any elevator walls, floor, and ceiling must be covered with 2 layers of 6 mil fire retardant poly. The elevator door must be in a positively pressurized area outside the clean room of the Decontamination unit. At completion of the abatement work, the elevator must be cleaned as per this section.

D. **SECONDARY BARRIERS**: A loose layer of 6 mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced at the end of each work shift or as needed during the work.

E. **EXTENSION OF THE REGULATED AREA**: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be added to the regulated area, decontamination measures must be started immediately and

continue until air monitoring indicates levels outlined in "Asbestos Control Area" for outside the work area, above, are met.

F. **FIRESTOP REQUIREMENTS**: Through penetrations caused by cables, cable trays, pipes, sleeves must be firestopped with a fire-rated firestop system providing an air tight seal. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the AOC Fire Protection Division. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement process shall immediately be brought to the attention of the AOC Fire Protection Division. All walls, floors and ceilings are considered fire rated unless otherwise determined by the AOC Fire Protection Division.

1. Any visible openings whether or not caused by a penetration shall be reported by the contractor to the AOC Fire Protection Division for a sealant system determination.
2. For firestops, contact the AOC Fire Protection Division for the opening size, penetration, and fire rating requirements.

G. **PRESSURE DIFFERENTIAL**: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of minus 0.02 inch water column. Before any disturbance of any asbestos material, this shall be demonstrated to the AOC by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(e)(5)(i). The Competent Person shall be responsible for providing and maintaining the negative pressure and air changes as required by OSHA and this specification. In any AOC-occupied building or facility, the abatement contractor is responsible for providing twenty four (24) hour, seven (7) days a week observation of the negative pressure air system once asbestos removal starts. This observation shall continue until final air clearance criteria are met. The suspension of this requirement can only be approved by the AOC/SOHB. Instructions to be followed during the observations will be outlined during the CIH pre-abatement coordination meeting specified in Part 1 above.

H. **MONITORING**: The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least minus 0.02 inch water column for the duration of the project.

I. **SUPPLEMENTAL MAKE-UP AIR INLETS:** Provide, as needed for proper air flow in the regulated area, in a location approved by the Project CIH, by making openings in the plastic sheeting to allow outside air to flow into the regulated area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system. The flap must be sprayed with adhesive to assure sealing if it closes.

J. **TESTING THE SYSTEM**: The negative pressure system must be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the

decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate the operation and testing of the negative pressure system to the AOC/SOHB using smoke tubes and a negative pressure gauge to document the negative pressure and air flow. Testing must also be done at the start of each work shift.

K. **DEMONSTRATION OF THE NEGATIVE AIR PRESSURE SYSTEM**: The demonstration of the operation of the negative pressure system to the AOC/SOHB shall include, but not be limited to, the following:

1. **Plastic barriers** and sheeting move lightly in toward the regulated area.
2. **Curtains of** the decontamination units move in toward regulated area.
3. **There is a** noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment to the regulated area.
4. **Use smoke tubes** to demonstrate air is moving air across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at least 5.0 Pa (minus 0.02 inch) across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.

L. **USE OF THE NEGATIVE PRESSURE SYSTEM DURING ABATEMENT OPERATIONS**:

1. **Start units before** beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining a minimum of 4 actual air changes per hour at a negative pressure differential of 5.0 Pa (minus 0.02 inch) water column, for the duration of the work until a final visual clearance and final air clearance has been completed.
2. **The negative air** machines shall not be shut down at any time during the duration of the project unless it has been authorized by the AOC/SOHB.
3. **Abatement work shall** begin at a location farthest from the units and proceed toward them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all necessary units are operating properly again.
4. **The negative air** machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been completed for that regulated area.

M. **DISMANTLING THE SYSTEM**: After completion of the final visual and final air clearance has been obtained, the units may be shut down. The units shall have been completely decontaminated, all pre-filters removed and disposed of as asbestos waste, and the unit inlet and outlet sealed with 2 layers of 6 mil poly.

N. **Before the work is begun**, clean all removable items and equipment. Remove them from the work area and store as directed.

O. **Cover all non-removable items** and equipment in the work area with six (6) mil flame retardant plastic sheeting taped securely in place.

P. **When specified,** remove all heating, ventilation, and air conditioning system filters, pack them in sealable double approved disposal bags or containers for disposal in the approved waste disposal site and replace them with new filters upon completion of abatement. Openings created by the removal of HVAC filters shall be sealed using 6 mil plastic sheeting taped securely in place, prior to start of work.

Q. **Post warning signs**: on the primary containment as required by 29 CFR 1910.1001, 29 CFR 1926.1101, ASTM E 849, as directed by District of Columbia Title 20 DCMR, Section 800 "Control of Asbestos" and as directed by the Architect.

R. **Obtain Approval of the Finished Primary Containment** from the Project CIH, prior to starting any actual asbestos removal work.

3.2 WORK PROCEDURE:

A. **General Procedures:** The enclosed work areas shall be defined as an asbestos regulated area and all asbestos worker protection and work practices not addressed in this specification shall be performed in conformance with the general safety and health provisions of 29 CFR 1910.1001, 29 CFR 1910.20, and the construction industry standard for asbestos, 29 CFR 1926.1101, respectively. The Project CIH shall review work area air samples and make adjustments for the type of respiratory protection required. For asbestos abatement work, use general work practices, work practices for removal, and work practices for encapsulation as specified in 29 CFR 1926.1101. If a conflict arises, the more stringent application shall apply until a determination is made by the Architect.

B. **PROTECTIVE CLOTHING:** Provide boots, booties, hard hats, goggles, clothing, respirators and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). Provide all personnel entering the regulated area with disposable full body coveralls, disposable head covering, and 18 inch boot coverings. The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Provide plastic/rubber disposable gloves for hand protection. Cloth type gloves may be worn under plastic/rubber gloves, but cannot be used alone. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

C. **Local Exhaust System:** Provide a local HEPA filtered exhaust system in the asbestos control area. The local HEPA filtered exhaust system shall exhaust to the outside of the building. Local HEPA filtered exhaust equipment must be sufficient to maintain a negative air pressure of 0.02 inch of water anywhere in the asbestos control area. In no case shall the building ventilation system be used as the local exhaust system for asbestos control. Filtering in vacuums and exhaust equipment shall be HEPA filtered equipped and conform to ANSI Z9.2; HEPA filters shall be used in all vacuums and exhaust equipment. NOTE: Approval from the AOC/SOHB is required for all local HEPA filtered exhaust systems that cannot be exhausted directly outside the building. To exhaust an HEPA filtered local exhaust system from an asbestos control area to the inside an AOC building will require the

approval of the AOC/SOHB. The HEPA filtered exhaust equipment shall also pass a Dioctylphthalate (DOP) test for HEPA filtered equipment each time a containment that is to be exhausted into the building is erected.

D. **CONTROLLING ACCESS TO THE REGULATED AREA:** Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA Danger asbestos signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of opaque fire retardant poly sheeting at least 6 mils thick to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

E. **Coordination of Work of all Trades:** Coordinate the work of all trades to assure that their work is performed in accordance with the applicable regulations and that the asbestos control limits are maintained at all times both inside and outside the asbestos work area.

3.3 WET REMOVAL OF ACM OTHER THAN AMOSITE ASBESTOS

A. **Adequately and** thoroughly wet the ACM to be removed prior to removal to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulant must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, any outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. (Note: In no event shall dry removal occur except when a permit is granted for unavoidable safety hazards.)

B. **If ACM does** not wet well with amended water due to coating or jacketing, remove as follows:

1. **Mist work area** continuously with amended water whenever necessary to reduce airborne fiber levels.
2. **Remove saturated** ACM in small sections. Do not allow material to dry out. As material is removed, place the material, while still wet, into 6-mil poly asbestos waste bags. Twist tightly the bag neck, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean/decontaminate the outside of any residue and move to wash down station adjacent to EDF.

3. **Fireproofing or Architectural Finish on Scratch Coat:** Spray with a fine mist of amended water or removal encapsulant. Allow time for saturation to the substrate. Do not over saturate causing excess dripping. Scrape material from substrate. Remove material in manageable quantities and control falling to staging or floor. If the falling distance is over 20 feet (6M), use a drop chute to contain material through descent. Remove residue remaining on the scratch coat after scraping is done using a stiff bristle hand brush. If a removal encapsulant is used, remove residue completely before the encapsulant dries. Re-wet the substrate as needed to prevent drying before the residue is removed.
4. **Fireproofing or Architectural Finish on Wire Lath:** Spray with a fine mist of amended water or removal encapsulant. Allow time to completely saturate the material. Do not over saturate causing excess dripping. If the surface has been painted or otherwise coated, cut small holes as needed and apply amended water or removal encapsulant from above. Cut saturated wire lath into 2 by 6 feet (50 by 150 mm) sections and cut hanger wires. Roll up complete with ACM, cover in burlap and hand place in disposal bag. Do not drop to floor. After removal of lath/ACM, remove any over spray on decking and structure using stiff bristle nylon brushes. Depending on hardness of over spray, scrapers may be needed for removal.
5. **Pipe Insulation:** Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6 inches from the point it contacts the ACM.

3.4 WET REMOVAL OF AMOSITE ASBESTOS

A. **Amosite ACM** will require local exhaust ventilation and collection, as described below, in addition to wet removal. Provide specific description /locations/drawings.

B. **Provide local** exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 12-inch flexible rigid non-collapsing duct shall be located no more than 2 feet from any scraping/brushing activity. Primary filters must be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity must have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe, attach a 4-foot square flared end piece on the intake of the duct. Support the duct horizontally at a point 2 feet below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.

C. **Amosite asbestos** does not wet well with amended water. Submit full information and documentation on the wetting agent proposed prior to start for review by the AOC/SOHB representative. Insure that the material is worked on in small sections and is thoroughly and continuously wetted. Package immediately after removal while wet. Remove as required.

3.5 NEGATIVE PRESSURE GLOVEBAG METHOD OF ASBESTOS REMOVAL:

A. **General:** If specifically permitted, the glovebag method may be used for removing pipe insulation on a case by case basis. Approval from the AOC/SOHB, to use this method is required. The Project CIH will determine what personal decontamination procedures are required. Respiratory protection and disposable clothing are required. Discard the clothing in accordance with paragraph Disposal of friable asbestos.

B. **Procedure:** Install the glovebag and negative pressure equipment following all procedures outlined in OSHA's 29 CFR 1926.1101.

C. **Removal and Disposal of Glovebags:** Removal of glovebags shall be in accordance with 29 CFR 1926.1101. Dispose of glovebags, material, and contaminated equipment in accordance with paragraph Disposal of Friable Asbestos.

3.6 SMALL SCALE SHORT DURATION PROJECTS - USE OF MINI-ENCLOSURE SYSTEM

A. **General:** If specifically permitted, a mini-enclosure system may be utilized for projects of short duration where there is less than three (3) square or three (3) linear feet of asbestos to be disturbed. A mini-enclosure system is defined as any portable system capable of performing small scale short duration projects equipped with all aspects of a full containment. This includes, but is not limited to the following components: negative air pressure, shower or water-tank facilities, HEPA vacuums, and polyethylene sheeting barriers. This work is best performed on flat ceiling surfaces, however it can be applied to horizontal wall surfaces. Use of this system is applicable to the following activities:

1. Access above asbestos containing lay-in ceilings
2. Wall channeling
3. Removal of light fixtures in plaster ceilings to access ceiling spaces
4. Changing light fixtures
5. Removal of ceiling tiles to access ceiling spaces
6. Impact or repair to asbestos ceiling plaster (e.g., hanging conduit or other such projects necessitating disturbance to the asbestos surfaces)
7. Removal of duct mastic
8. Removal of transite asbestos panel boards

B. **Procedure**: Utilize a negative pressure mini-enclosure system for this work. This process will follow all procedures outlined in OSHA's 29 CFR 1926.1101. The following steps are to be when performing this work:

1. **Preliminary setup:** Seal all critical barriers (e.g., doors, windows, vents) in the work area. Place OSHA warning signs as necessary facing outward on perimeter doors. Pre-clean area beneath work by wet wiping and HEPA vacuuming. Place drop cloth on surfaces below work and seal ir to floor with duct tape. Disconnect, as necessary, the electric and lock out power to breaker. Check and pressurize water within holding tanks, and nozzles on the enclosure system. Provide ground-fault protection for other outlets.

2. **Preliminary Inspection:** Project CIH will inspect area prior to commencement of work. Verify that all preliminary set-up procedures, as stated above, have been completed. Verify that all filters are properly positioned in HEPA vacuums and negative air machines (NAM). Verify all equipment is operating properly. Review, with contractor, the CIH Approved Plan of Action specified in "Submittals" in Part 1 of this specification.
3. **Work Procedures:** Workers will don two (2) suits, gloves and appropriate respiratory protection in accordance with 29 CFR 1910.134. Workers will activate the negative air system associated with the mini-enclosure. The workers, in accordance with all applicable Federal and District of Columbia regulations, will perform necessary removal and/or encapsulation of asbestos containing material. Non-asbestos containing material to be salvaged, as stated in scheduled work plan, shall be properly decontaminated prior to its removal from the work area.
4. **Waste Removal:** All asbestos containing materials shall be sufficiently wet and placed in bags, drums, or other approved and labeled disposal containers. All waste disposal containers shall be properly decontaminated. Disposal shall be performed as specified in "Cleanup and Disposal" below.
5. **Decontamination Procedures:** Thoroughly clean via wet wiping and HEPA vacuuming all surfaces within the mini-enclosure so that no visible residue remains. Workers will decontaminate by HEPA vacuuming the outer protective suit. Workers will reinspect the area for visible residue, clean as necessary, then decontaminate the inner protective suit. Once entire area is completely decontaminated, the workers may remove and properly dispose of the second suit and shower. Once showered, the worker may exit the mini-enclosure system and remove respiratory protection. If a remote shower facility is utilized, the workers shall follow the same procedure as stated above, however, the second suit shall be removed upon entering the remote shower facility.
6. **Final Visual Inspection:** Once all work for the specified area has been completed and workers have exited the mini-enclosure system, the Project CIH will enter the enclosure system to perform a final visual inspection to insure that there is no visible residue and all work has been completed.
7. **Final Air Sample Clearance:** The following final clearance sampling procedure shall be followed for mini-enclosure systems. If the work area passes final visual inspection, a final clearance air sample shall be conducted by the Project CIH inside the mini-enclosure system. The clearance air sample will have a total volume of at least 1200 liters of air and shall be analyzed by Phase Contrast Microscopy (PCM) following the NIOSH 7400 method A rules. This sample shall be read on-site by the Project CIH. Upon failure of the clearance sample by PCM analysis, another sample shall be conducted and analyzed by Transmission Electron Microscopy (TEM) and submitted to an accredited laboratory with all extra cleaning and sampling at no cost to the Government.
8. **Post-Clearance:** Upon clearance of the mini-enclosure system both by visual and air sampling, the system can be used at another location, leaving the previous work area non-hazardous for other trades to perform routine work.

3.7 QUALITY CONTROL:

A. **Monitoring:** Monitoring of airborne concentrations of asbestos shall be in accordance with 29 CFR 1910.1001, 29 CFR 1926.1101, ASTM E 849, and this specification.

1. **Monitor the airborne concentration** of asbestos before constructing the containment work area, to obtain a baseline fiber concentration in the affected areas. If the baseline air monitoring results, exceeds 0.01 f/cc immediately notify the AOC/SOHB.
2. **Monitor continuously** during the course of the work inside the asbestos work area and other areas as directed by the Project CIH's air sampling strategy. In addition to that sampling strategy, and at a minimum, perform daily monitoring outside the entrance to the asbestos work area, along each perimeter wall of the containment and at the exhaust opening of the local exhaust system. If monitoring shows airborne concentrations greater than the asbestos control limits permitted by this specification, immediately stop all work, and notify the AOC/SOHB. Work shall not be restarted without approval of the Project CIH and the AOC/SOHB.
3. **In addition,** monitor the airborne concentrations of asbestos after final cleanup and removal of the enclosure of the asbestos control area in accordance with paragraph "Final Cleanup and Removal of Enclosures."

B. **Site Inspection and Stop Work Orders:** While performing asbestos abatement work, the Contractor shall be subject to on site inspection by agency officials or agency contracted inspection services. Work shall also be subject to inspection by OSHA and EPA inspectors and/or local building or health officials. If found to be in violation by one of these officials, the Contractor shall cease all work immediately. Until the violation is resolved, standby time required to resolve the violation shall be at the Contractor's expense. Five complete sets of equipment (such as respirators and disposable clothing) required for entry to the asbestos control area shall be available for inspectors use.

3.8 CLEANUP AND DISPOSAL:

A. **Permits and Notifications:** Secure necessary permits in conjunction with asbestos removal, hauling and disposition and provide timely notification of such actions, as may be required by Federal, state, regional, and local authorities. When required by regulation, ensure that notification to the Regional Office of the EPA and the responsible agency for the District of Columbia is made,; provide copies of the notification to the AOC/SOHB 20 days prior to the commencement of the work. Provide notification in accordance with 40 CFR 61.22(d)(1).

B. **Housekeeping:** Essential parts of asbestos dust control are housekeeping and cleanup procedures. All surfaces throughout the containment work area shall be maintained free of accumulations of asbestos fibers to prevent further dispersion. Give meticulous attention to restricting the spread of dust and debris, keep waste from being distributed over the general area. Use approved industrial vacuum cleaners with a HEPA filters to collect dust and small scrap. The use of compressed air is forbidden. Post appropriate asbestos hazard warning signs. At the end of each work shift, the containment area shall be cleaned. Equip personnel engaged in cleaning up asbestos scrap and waste with necessary respiratory equipment and protective clothing.

C. **Disposal of Friable Asbestos:** Collect and dispose of friable asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing which may produce airborne concentrations of asbestos fibers in disposal bags or containers approved as specified in Part 1 above for post-award submittals. Prior to placing in bags or containers, thoroughly wet down asbestos wastes to reduce airborne concentrations. All asbestos waste shall be double bagged, wrapped or contained in accordance with 40 CFR Subpart M. At the end of each work shift, all waste asbestos materials shall be removed from the containment. Obtain approval from the AOC/SOHB and affected AOC building Superintendent's office, when the removal of the containerized asbestos waste is scheduled from the containment area. The contractor shall make arrangements for the transportation and disposal of all asbestos waste generated under this specification in accordance with all Federal regulations at a sanitary landfill that meets EPA requirements. The Contractor will provide the AOC/SOHB with a copies of all Waste Shipment Records, hauler's receipts, and landfill receiving tickets resulting from the disposal of the asbestos waste as specified in Part 1 above for disposal receipt submittals. Establishment of any on-site temporary holding area for properly packaged asbestos waste must have prior approval from the AOC/SOHB. At no time shall the Contractor receive any asbestos-containing waste from other jobs, compliance inspectors or other sources without prior approval from the AOC/SOHB.

D. **Final Cleanup:** The Contractor shall notify the AOC/SOHB and the Project CIH that the work area is ready for final inspection. The Project CIH shall inspect the work area prior to performing final air sampling. Visual observation of asbestos materials, dust or debris is not permitted on any surface in or around the work area. Clean work area in accordance with EPA approved methods. Once the visual observation is satisfied apply a lock down encapsulant.

E. **Lock down encapsulation:** Lock down encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before final air sampling, all surfaces shall be encapsulated with a lock down encapsulant. Apply two coats of encapsulant in strict accordance with the manufacturer's instructions. Any deviation from the instructions must be approved by the AOC's representative in writing prior to commencing the work. Apply the first coat of encapsulant with an airless sprayer at a pressure and using a nozzle orifice as recommended by the manufacturer. If the surface has been allowed to dry, wet wipe or HEPA vacuum prior to spraying with encapsulant. Apply a second coat over the first coat in strict conformance with the manufacturer's instructions. Color the encapsulant and contrast the color in the second coat so that visual confirmation of completeness and uniform coverage of each coat is possible. Adhere to the manufacturer's instructions for coloring. At the completion of the encapsulation, the surface must be a uniform third color produced by the mixture.

1. **EXPOSED EDGES**: Seal edges of ACM exposed by removal work such as ACM left due to being outside the scope of work for this contract, or is inaccessible such as a sleeve or wall penetration, with one coat of penetrating encapsulant and one coat of bridging encapsulant. Prior to sealing, permit the exposed edges to dry completely in between the coats to permit penetration of the encapsulant.

F. **Final Air Sampling:** Perform air sampling for clearance purposes using a minimum of two (2) Transmission Electron Microscopy (TEM) air samples for each 2500 square feet of

containment area. Repeat the decontamination and testing process until asbestos concentration levels are less than 0.01 s/cc (NIOSH 7402 method) or 70 S/mm^2 (AHERA). Copies of the TEM air sample results are to be faxed to the District of Columbia Department of Health, Air Quality Division.

G. **Removal of Enclosure:** If asbestos concentrations do not exceed 0.01 s/cc or 70 S/mm^2, contact the AOC/SOHB for authorization for the removal of the enclosure. Ensure that copies of the TEM air sample results are telefaxed to the District of Columbia Department of Health, Air Quality Division.

H. **Re-Occupancy Inspection:** The Contractor shall notify the AOC/SOHB and the Project CIH that the work area is ready for re-occupancy inspection. The Project CIH, shall inspect the work area after removal of the enclosure and shall ensure that no visible debris is observed. If visible debris is observed, the Contractor shall clean the work area as directed by the Project CIH, in accordance with EPA approved methods until no visible debris are observed. The Project CIH shall provide verbal re-occupancy approval to the AOC/SOHB immediately after this inspection. Documentation of the re-occupancy inspection shall be provided to the AOC/SOHB within 24 hours after approving an area for re-occupancy.

END OF SECTION 13281

SECTION 13282 - LEAD ABATEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies abatement and disposal of lead containing products and controls needed to limit occupational and environmental exposure to lead hazards.

1.2 SCOPE OF WORK

A. The contractor shall follow the contract drawings and specifications. Where lead painted surfaces are disturbed, follow requirements of this section.

B. The following are painted with lead-containing paint which is to be disturbed and removed:

Material or Surface	Space or Area
Air handling unit casings, fans, and plenums	7th Floor - Mechanical Room
Air handling unit ductwork	7th Floor - Mechanical Room
Air handling unit chilled water piping	7th Floor - Mechanical Room
Air handling unit steam and return piping	7th Floor - Mechanical Room
Steam and return piping	Sub Basement Mechanical Room

1.3 APPLICABLE PUBLICATIONS

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

B. **CODE OF FEDERAL REGULATIONS (CFR):**

CFR 29 Part 1910	Occupational Safety and Health Standards
CFR 29 Part 1926	Safety and Health Regulations for Construction
CFR 40 Part 148	Hazardous Waste Injection Restrictions
CFR 40 Part 260	Hazardous Waste Management System: General
CFR 40 Part 261	Identification and Listing of Hazardous Waste
CFR 40 Part 262	Standards Applicable to Generators of Hazardous Waste
CFR 40 Part 263	Standards Applicable to Transporters of Hazardous Waste
CFR 40 Part 264	Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities

CFR 40 Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
CFR 40 Part 268	Land Disposal Restrictions
CFR 49 Part 172	Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
CFR 49 Part 178	Specifications for Packaging
CFR 40 Part 173	General requirements for shipments and packaging

C. **National Fire Protection Association (NFPA):**

NFPA 701-1989	Methods of Fire Test for Flame-Resistant Textiles and Films

D. **National Institute For Occupational Safety And Health (NIOSH)**

NIOSH OSHA Booklet 3142 Lead in Construction

E. **Underwriters Laboratories(UL):**

UL 586-1990 High-Efficiency, Particulate, Air Filter Units

F. **American National Standards Institute:**

Z9.2-1979(R1991)	Fundamentals Governing the Design and Operation of Local Exhaust Systems.

G. **HUD's Guidelines For the Evaluation and Control of Lead - Based Paint Hazards in Housing**

1.4 DEFINITIONS

A. **Action Level**: Employee exposure, without regard to use of respirations, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, 30 micrograms per cubic meter of air" refers to the action level.

B. **Area Monitoring**: Sampling of lead concentrations which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.

C. **Physical Boundary**: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."

D. **Certified Industrial Hygienist (CIH):** As used in this section, refers to an Industrial Hygienist employed by the contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.

E. **Change Rooms and Shower Facilities:** Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross- contamination.

F. **Competent Person:** A person capable of identifying lead hazards in the work area and is authorized by the contractor to take corrective action.

G. **Decontamination Room:** Room for removal of contaminated personal protective equipment (PPE).

H. **Eight-Hour Time Weighted Average (TWA):** Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.

I. **High Efficiency Particulate Air (HEPA) Filter Equipment:** HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

J. **Lead:** Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. **Lead Control Area:** An enclosed area or structure with full negative pressure containment to prevent the spread of lead dust, paint chips, or debris of lead-containing material removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. **Lead Permissible Exposure Limit (PEL):** Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula. PEL (micrograms/cubic meter of air) = 400/No. of hrs worked per day

M. **Personnel Monitoring:** Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 mm to 225 mm (6 to 9 inches) and the center at the nose or mouth of an employee.

N. **Architect:** The Architect of the Capitol.

1.5 QUALITY ASSURANCE

A. **Before exposure** to lead-contaminated dust, show evidence that workers have completed the comprehensive medical examination as required by 29 CFR 1926.62 (I) (1) (i) & (ii).

The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62(i) within the last year.

B. **Medical Records:** Maintain complete and accurate medical records of employees in accordance with 29 CFR 1910.20.

C. **The Contractor** shall engage the services of an Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene (ABIH). Selection of the CIH is subject to approval of the Architect. The CIH will be responsible for, but not limited to the following:

1. **Certify** Training.
2. **Review, approve and submit** to the Architect's representative, all lead-containing material removal plan for conformance to the applicable referenced standards.
3. **Inspect and or oversee** the inspection of, all lead-containing material removal work for conformance with the approved plan.
4. **Develop** a monitoring plan and/or perform the monitoring. This is to include samples to test airborne levels of lead to determine exposure.
5. **Ensure work** is performed in strict accordance with specifications at all times.
6. **Ensure hazardous exposure** to personnel and to the environment are adequately controlled at all times.
7. **Visually inspect** all lead control areas for cleanliness and perform floor dust wipe testing.
8. **Review and approve** and submit to the Architect's representative, all sampling data within the time frames outlined in this specification.
9. **Review, approve and submit** to the Architect, the Contractor's lead compliance program in accordance with 29 CFR 1926.62(e)(2).

    a. The CIH may delegate the performance of his work, (except for the reviews and approval of plans, programs and sampling strategies), to Industrial Hygienist (IH) he selects, who are qualified by virtue of their training and work experiences to perform tasks. The CIH shall supervise the IH or all of the IH (s) and will be responsible for and review all results of their work. The selection of the CIH and the IH (s), is subject to approval of the Architect.

D. **Training:** Train each employee performing lead paint removal, lead containing material removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62. Provide RCRA hazardous training in accordance with 40 CFR 265.16 to account for proper management of lead containing hazardous wastes.

E. **Training Certification:** The CIH shall certify all contractor employee Lead Training Certificates. These documents shall be submitted to the Architect as directed by section 1.6.D.6.c of this specification.

F. **Respiratory Protection Program:**

1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at intervals that are required by 29 CFR 1910.134.
2. The contractor shall establish and implement a respiratory protection program that has been approved and certified by the project CIH as required by 29 CFR 1910.134, 29 CFR 1910.1025, and 29 CFR 1926.62.

G. **Hazard Communication Program:** The contractor shall establish and implement a Hazard Communication program that has been approved and certified by the project CIH as required by 29 CFR 1910.1200. Once approved by the Architect and before any work starts, the contractor shall implement this plan.

I. **Safety and Health Compliance:**

1. **In addition** to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, licensing and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62 and this specification. Submit matters regarding interpretation of standards to the Architect for resolution before starting work.
2. **Where specification** requirements and the referenced documents vary, the most stringent requirements shall apply.

J. **Pre-Construction Conference:** Ten (10) days before beginning any lead containing material removal, the CIH and removal contractor shall meet with the Architect's Occupational Health, Environmental, and Safety Office representative to discuss in detail the lead-containing paint and or material removal work plan. The topic of the Pre-Construction Conference shall include work procedures and precautions for the work plan.

K. **Supervision:** The competent person assigned to this operation by the contractor, shall be required to be onsite and supervising any and all work being performed inside the Lead Control area.

1.6 SUBMITTAL

A. **General:** No work involving the removal of lead containing materials shall begin until all submittal required by this specification are approved by the Architect.

B. **Hazardous Waste Management:**

1. **Submit a Hazardous Waste Management Plan** within 14 days after award of contract to the Architect for approval. The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations and address:

   a. Procedures to segregate abatement wastes into separate waste streams to minimize the quantity of hazards waste generated.
   b. Testing to identify hazardous wastes associated with the work.

c. Estimated quantities of wastes to be generated and disposed of.
d. Transporter / disposal facility documentation including, name, location, EPA identification number, hazardous waste permits and a 24 hour point of contact.
e. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
f. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
g. Spill prevention, containment, and cleanup contingency measures to be implemented.
h. Procedures and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.

2. **Obtain Architect's generator EPA** identification number from the Architect. Contact the Architect's Environmental Branch representative for this information.

B. **Manufacturer's Catalog Data:**

1. HEPA Vacuums
2. Respirators
3. HEPA filtered negative air machines.
4. LBP Removal Chemicals.
5. All other tools or equipment that the contractor plans on using to remove Lead - Containing materials.

C. **Instructions:** Paint removal materials. Include applicable material safety data sheets.

D. **Statements Certifications and Statements:**

1. **Qualifications of CIH:** Submit to the Architect for approval the name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH on five (5) projects of comparable size, cost and complexity. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/re-certification.
2. **Qualifications of Competent Person:** Submit to the Architect for approval the name, address, and telephone number of the Competent Person assigned to supervise this operation. Provide all previous experience of the Competent Person related to Lead Abatement operations.
3. **Testing Laboratory:** Submit to the Architect for approval, the name, address, and telephone number of the testing laboratory selected to performing the analysis and reporting of airborne concentrations of lead wipes, and TCLP sampling. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the American Industrial Hygiene Association (AIHA). Environmental Lead Proficiency Analytical Testing Program (ELPAT). The laboratory shall be accredited by the American Industrial

Hygiene Association (AIHA). Provide AIHA and ELPAT documentation along with date of accreditation / re-accreditation.

4. **Lead-Containing Material Removal Plan:** Ten (10) days before work starts, submit to the Architect for approval, a detailed job-specific plan, approved by the CIH, of work procedures to be used in the removal of lead-containing paint or materials. The plan shall include the name of the Competent Person assigned to supervise the operation, a sketch showing the location, size, and details of lead control areas, type of containment materials used, location and details of decontamination rooms, change rooms, shower facilities, and HEPA filtered mechanical ventilation system.

   a. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and lead paint and/or lead containing material debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.

   b. Include air and floor wipe sampling, strategy, sampling methodology, frequency, duration of sampling, and qualifications and training of air monitoring personnel in the sampling portion on the plan.

5. **Field Test Reports:** Monitoring Results: Submit all monitoring results to the Architect's Occupational Health, Environmental, and Safety Office representative, by the next work day. All monitoring and floor wipe test results shall be signed by the testing laboratory, the employee performing the sampling, the employee that analyzed the sample, and the CIH. The quickest turn around time available, shall be used for all floor wipe tests, taken to clear a lead control area.

6. **Records:**

   a. Submit completed and signed hazardous waste manifest from treatment or disposal facility.
   b. Before work starts, submit to the Architect for approval, certification of Medical Examinations as required by 29 CFR 1926.62. The CIH shall certify that all employees, who will be engaged in lead - containing material removal operations, have been medically cleared as required by 29 CFR 1926.62.
   c. Before work starts, submit to the Architect for approval, certification of employee training certified by the CIH.
   d. Before work starts, submit to the Architect for approval, the CIH approved, the contractor's employee respiratory protection program.
   e. Before work starts, submit to the Architect for approval, certification of employees respirator fit testing certified by the CIH.
   f. Before work starts, submit to the Architect for approval, the CIH approved copy of the Hazard Communication Program as required by 29 CFR 1910.1200.

g. Before work starts, submit to the Architect for approval, the Contractor's CIH approved lead compliance program in accordance with 29 CFR 1926.62(e)(2).

PART 2 PRODUCTS

2.1 PAINT REMOVAL PRODUCTS:

A. **Submit for approval,** applicable Material Safety Data Sheets for paint removal products used in paint removal work. Use the least toxic product, suitable for the job and acceptable to the CIH.

PART 3 EXECUTION

3.1 PROTECTION

A. **Notification:** Notify the Architect's Occupational Health, Environmental, and Safety Office representative 10 days prior to the start of any lead abatement work.

B. **Lead Control Area Requirements:**

1. **Establish a lead control area** by completely enclosing with 6 mil poly, where lead-containing material removal operations will be performed.
2. **Contain removal operations** by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust, exhausted to the outside of the building. The negative pressure containment, shall have a minimum of 6 air changes per hour. The contractor shall maintain a -0.020 column inches of water pressure differential, relative to outside pressure. This measurement shall be recorded and maintained within the enclosure as evidenced by manometric measurements and maintained around the clock, or until authorization for containment removal is obtained from the Architect. Hourly readings shall be recorded while lead removal work is being performed. Anytime the negative pressure is less than -0.020 column inches of water pressure differential, relative to outside pressure, all lead removal work inside the containment will stop. The work may be restarted only after the negative pressure is restored to a level of -0.020 column inches of water pressure differential or greater, relative to outside pressure.

C. **Protection of Existing Work to Remain:** Perform Lead - Containing Material removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, the contractor will restore it to its original condition.

D. **Boundary Requirements:** Provide physical boundaries around the lead control area by sealing off the area designated on the approved work plan to ensure that airborne concentrations of lead will not reach 20 micrograms per cubic meter of air outside of the lead control area.

E. **Heating, Ventilating and Air Conditioning (HVAC) Systems:** Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

F. **Change Room and Shower Facilities:** Provide clean change rooms and shower facilities within the physical boundary around the designated lead control area in accordance with requirements of 29 CFR 1926.62.

G. **Mechanical Ventilation System:**

1. **Use adequate ventilation** to control personnel exposure to lead in accordance with 29 CFR 1926.62.
2. **Contain removal operations** by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust, exhausted to the outside of the building. The negative pressure containment, shall have a minimum of 6 air changes per hour. The contractor shall maintain a -0.020 column inches of water pressure differential, relative to outside pressure. This measurement shall be recorded and maintained within the enclosure as evidenced by manometric measurements and maintained around the clock, or until authorization for containment removal is obtained from the Architect. Hourly readings shall be recorded while lead removal work is being performed. Anytime the negative pressure is less than -0.020 column inches of water pressure differential, relative to outside pressure, all lead removal work inside the containment will stop. The work may be restarted only after the negative pressure is restored to a level of -0.020 column inches of water pressure differential or greater, relative to outside pressure.

H. **Personnel Protection:** Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. The CIH shall initially select the appropriate respiratory protection to be used by the employees as required by 29 CFR 1926.62.

I. **Warning Signs:** Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.2 WORK PROCEDURES

A. **Perform removal of Lead-Containing Material** in accordance with approved Lead-Containing Material removal plan. The assigned Competent Person shall supervise the work and will be on site anytime work in the Lead Control area is on-going. This person shall use procedures and equipment required to limit occupational and environmental exposure to lead when Lead - Containing Material is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed Lead-Containing Material, any paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.

B. **Personnel Exiting Procedures:** Whenever personnel exist the lead-controlled area, they shall perform the following procedures and shall not leave the work until:

1. **Vacuum** themselves off.
2. **Remove protective clothing** in the decontamination room, and place them in an approved impermeable disposal bag.
3. **Shower.**
4. **Change** to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.

C. **Monitoring:** Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1926.62 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH.

1. **The CIH or the IH Technician** under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the Lead - Containing Material removal work to ensure that the requirements of this specification have been satisfied during the entire Lead - Containing Material removal operation.
2. **Personal air monitoring samples** shall be taken on employees who are anticipated to have the greatest risk of exposure as determined by the CIH.
3. **Submit results of air monitoring samples**, signed by the CIH, by the next work day after the air samples are taken. Notify the Architect immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.

D. **Monitoring During Lead-Containing Material Removal Work:**

1. **Perform personal and area monitoring** during the entire Lead-Containing Material removal operation. Sufficient area monitoring shall be conducted at the physical boundary outside the lead control area to ensure unprotected personnel are not exposed above 20 micrograms per cubic meter of air.

   a. If the outside boundary lead levels are at or exceed 20 micrograms per cubic meter of air, work shall be stopped and the CIH shall notify the Architect immediately.

      1) The CIH shall immediately investigate, perform necessary air and/or wipe sampling and render a decision as whether these areas are contaminated are not. The findings of the investigation and the results of any samples taken, shall be reported to the Architect immediately.
      2) If the area investigated by the CIH is found to be contaminated with lead, the following procedures shall be followed:

         a) Work in all lead containment operations shall remain halted.

b) The contractor shall decontaminate (clean up) the contaminated area.

c) The CIH shall determine the source and cause of the contamination, along with the necessary corrective measures to be taken.

d) The contractor shall decontaminate the contaminated area using the corrective measures outlined by the CIH.

e) The CIH shall visually inspect the "contractor cleaned" contaminated area and perform floor wipe tests. The number of floor wipe tests will be determined by the CIH. Results of the floor wipe tests shall be less than 100 $\mu g/ft^2$. The CIH shall submit copies of all sample results along with a certification that the area is no longer contaminated with lead.

f) If on the second try, the contractor is unable to achieve a floor wipe sample result of less than 100 $\mu g/ft^2$ for a particular area, the following procedures shall be followed:

(1) The CIH shall render a decision as to what clearance level would be achievable for that particular area.

(2) The CIH shall submit to the Architect this decision, along with copies of the sampling data for area, along with a certification that the area is no longer contaminated with lead.

g) The Architect will issue the authority to restart work in the lead control area, once the CIH certifies to the Architect, that the contaminated area has been successfully decontaminated.

2. **The CIH** shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the Architect.

3. **The Contractor** shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which Lead - Containing Material removal operations are performed in areas immediately adjacent to the lead control area. If any outside the work boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately correct the condition(s) causing the increased levels and notify the Architect immediately. Removal work shall resume when approval is given by the Architect.

3.3 LEAD-CONTAINING Material REMOVAL

A. **Remove Lead - Containing Material** within the areas designated on the approved Lead - Containing Material removal plan in order to completely expose the substrate. Take whatever precautions are necessary to minimize damage to the underlying substrate.

B. **Indoor Lead-Containing Material Removal:** Select Lead - Containing Material removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This Lead - Containing Material removal process shall be described in the Lead - Containing Material removal plan approved by the Architect.

C. **After beginning the Lead-Containing Material** removal operation or at the direction of the Architect, the following procedures shall be followed, concerning all reports of possible lead contamination in occupied spaces, within a building that has a Lead Control area:

1. **The CIH** shall immediately investigate, perform necessary air and/or wipe sampling and render a decision as whether these areas are contaminated and develop a corrective plan of action. The findings of the investigation and the results of any samples taken, shall be reported to the Architect immediately.
2. **If the area investigated** by the CIH is found to be contaminated with lead, the following procedures shall be followed:

   a. Work in all lead containment operations shall be halted.
   b. The contractor shall initiate the corrective plan of action plan developed by the CIH in order to decontaminate the area.
   c. The CIH shall determine the source and cause of the contamination, along with the necessary corrective measures to be taken to prevent a reoccurrence.
   d. Before any lead abatement work is restarted, the CIH must certify to the Architect, that the source and cause of the contamination has been corrected. Work may restart once approval from the Architect is received.
   e. The CIH shall visually inspect the "contractor cleaned" contaminated area and perform floor wipe tests. The number of floor wipe tests will be determined by the CIH. Results of the floor wipe tests shall be less than 100 $\mu g/ft^2$. The CIH shall submit copies of all sample results along with a certification that the area is no longer contaminated with lead.

   f. If on the second try, the contractor is unable to achieve a floor wipe sample result of less than 100 $\mu g/ft^2$ for a particular area, the following procedures shall be followed:

      1) The CIH shall render a decision as to what clearance level would be achievable for that particular area.
      2) The CIH shall submit to the Architect this decision, along with copies of the sampling data for area, along with a certification that the area is no longer contaminated with lead.

3.5 CLEANUP AND DISPOSAL:

A. **Cleanup:** Maintain surfaces of the lead control area free of accumulations of Lead - Containing Material chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the Lead - Containing Material removal operation has been completed, clean the area of all visible Lead - Containing Material contamination, dust and debris by vacuuming with a HEPA filtered vacuum cleaner and wet wipe and or mopping the area.

B. **Certification:** The CIH shall certify in writing the following:

1. **The inside and outside** of each lead control area air monitoring samples are less than 30 micrograms per cubic meter of air.
2. **The respiratory protection** for the employees was adequate and the work procedures were performed in accordance with 29 CFR 1926.62 and this specification, and that there were no visible accumulations of lead-contaminated Lead - Containing Material and dust on the work site.
3. **The CIH** shall perform floor wipe test(s) by using methodology that is outlined in HUD's Guidelines for the Evaluation and Control of Lead - Based Paint hazards in Housing. A Lead Control area is considered complete if all floor wipe sample results are below 100μg/ft². Do not remove the lead control area or roped-off boundary and warning signs prior to the Architect's approval and receipt of the CIH's certification.
4. **Re-clean and re-sample** any Lead Control area showing dust or residual Lead - Containing Material (chips) or floor wipe sample results that are above 100μg/ft².
5. **If after the second attempt**, the contractor is unable to achieve a floor wipe sample result of less than 100 g/ft² for a particular lead control area, the following procedures shall be followed:

    a. The CIH shall render a decision as to what clearance level would be achievable for that particular control area.
    b. The CIH shall submit to the Architect this decision, along with copies of the sampling data for containment removal approval.
    c. The Architect may have the CIH's decision reviewed by a third party CIH.

C. **Testing of Lead-Containing Material Residue:** Where indicated or when directed by the Architect, test all potential Lead - Containing waste by following the Toxicity Characteristic Leaching Procedure (TCLP) for lead in accordance with 40 CFR 261.

D. **Disposal:**

1. **Collect** all potential lead-contaminated waste, including but not limited to, removed paint chips, abrasive blast medium, architectural components, scrap, debris, bags, containers, equipment, and lead-contaminated clothing.
2. **For drummed waste,** store in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums to identify the type of waste (49 CFR 172) and the date lead contaminated wastes were first put into the drum. Comply with labeling, marking and placarding requirements described in 49 CFR 173.

For architectural components, e.g., doors, windows, and molding, store so as to prevent environmental contamination. Six - mil plastic sheeting should be placed underneath and on top of the material; plywood or other durable material should be placed on top of the plastic to prevent it from being punctured. Transport waste in covered vehicle only.

3. **Periodically remove hazardous wastes** so that 90 calendar day storage limitation is not exceeded.
4. **Handle, store, transport, and dispose** lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
5. **Disposal Documentation:** Submit written evidence that the hazardous waste transporter and the treatment, storage, or disposal facility (TSDF) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Submit Certification of disposal from TSDF.

3.6 SCHEDULE OF PROCEDURES

A. Lead-containing paint is assumed to be present on existing outer surfaces of air-handling unit casings, plenums, ducts, and steam condensate and chilled water piping that are being removed as part of the demolition work. Insulation on these items also contains asbestos. Remove asbestos-containing materials and lead-containing paint in a single process.

B. Channel walls or ceilings: Remove paint as specified in this section.

C. Holes in walls or ceilings to attach pipes, conduit, and equipment: Use the HEPA filter and glove bag method when drilling holes for the support of screws or passage of pipe or conduit.

D. Connection to painted junction boxes: Remove paint as specified in this section before opening junction box, installing new conduit connectors, and splicing conductors.

E. Removal of painted materials: Collect and store in drums as specified in this section. Turn drums over to Architect for disposal.

END OF SECTION 13282

SECTION 13931 - FIRE SUPPRESSION SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements for Fire Protection equipment and system, including maintenance agreement.

B. Sprinkler system is wet type.

C. Standpipe and hose system is wet type. The system and its components are shown on the drawings.

1.2 RELATED SECTIONS

A. Basic piping requirements: Section 15050.

B. Fire suppression system piping: Section 13932.

C. Fire suppression system specialties: Section 13933.

D. Automatic sprinklers: Section 13934.

1.3 REFERENCES

A. National Institute for Certification in Engineering Technologies (NICET).

1.4 DESIGN INFORMATION

A. Locations of service connection, mains and risers, zones, branch sprinkler lines, sprinkler heads, and Hazard Classifications are shown on drawings.

1.5 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop drawings:

Sprinkler System Working Plans

C. Certifications: Qualifications of installing company and system designer and reviewer.

D. Submit "Working Plans" as required by NFPA to the Architect, and obtain approval, before beginning the work.

1. Along with these plans, submit a schedule and cuts showing make, type, manufacturer's name, trade designation and proposed location of all pieces of

material and equipment proposed for use on this project. When approved, no variation will be permitted except with the approval of the Architect.

2. Working plans shall coordinate the sprinkler piping and sprinkler layout with the existing mechanical and electrical systems components.

   a. Sprinklers shall clear ceiling framework by six inch minimum. Coordinate locations of all sprinklers with existing lighting fixtures, ceiling air devices, and partition locations.
   b. Make working plans not less than 1/8 inch scale. Inspector's test locations shall be as shown on the drawings.

E. Submit hydraulic calculations with the working plans. Calculations shall be based on flow data and design criteria indicated on the drawings.

F. Project record drawings: Submit in electronic form as CAD files created with MicroStation.

1. Provide a set of 1/8 inch scale drawings of the building showing the installed locations of the piping and sprinklers serving the Seventh Floor mechanical area.
2. Submit as a shop drawing for approval before framing.
3. Frame one additional set of drawings, protected under watertight plastic covers, and hang in Seventh Floor mechanical area.
4. Provide one set for each Operating and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. The Fire Protection System shall be designed and installed by an approved qualified company, regularly engaged in the design and installation of these types of systems.

B. "Working plans" shall be designed and prepared by an individual certified at least Level III by NICET, and reviewed and signed by an individual certified at least Level IV.

C. Products specified in "Related Sections" shall be tested and labeled by an independent, nationally recognized testing and labeling authority, specifically for use in fire protection service.

1.7 REGULATORY REQUIREMENTS

A. Design and install the system in accordance with National Fire Protection Association Fire Codes, including the following, as applicable:

1. NFPA 13 Standard for the Installation of Sprinkler Systems.
2. NFPA 14 Standard for the Installation of Standpipe and Hose Systems.
3. NFPA 231 Standard for General Storage.
4. AOC Design Standards

B. Regulatory requirements establish minimums. Provide additional requirements shown or specified.

1.8 MAINTENANCE

A. After completion of the Fire Protection installation and at the start of the general project correction period, execute the National Automatic Sprinkler and Fire Control Association, Inc. standard form of "Inspection Agreement", without addition to the Contract Sum. Agreement shall call for four inspections of the sprinkler system during the correction period.

B. Make inspections as required in the Inspection Agreement. In addition, perform the following maintenance during the last inspection:

1. Operate all control valves.
2. Lubricate operating stems of all interior control valves.
3. Operate water motor gong and electric alarms.
4. Lubricate Fire Department hose connection inlets.
5. Clean alarm valves.

C. Fill out the standard form of the National Automatic Sprinkler and Fire Control Association, Inc., "Report of Inspection", after each inspection. Send copies to the Architect and other authorities designated by the Architect.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Mark the sprinkler pipe with letters of height, width and colors as required by OSHA and conforming to ANSI A13.01, Scheme for the Identification of Piping Systems, as specified in Section 15050. Do not mark until all finish painting is complete.

B. Identification is not required on branch sprinkler piping from which sprinklers are directly connected.

3.2 FIELD QUALITY CONTROL

A. The combined new and existing sprinkler system serving the Seventh Floor mechanical area shall be tested in accordance with requirements outlined in NFPA 13 and includes hydrostatic testing.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 15050, provide operating instructions.

B. Provide at least eight hours of additional instruction time for the equipment specified in this Section, consisting of two periods of four consecutive hours, during a period of not more than 60 days.

END OF SECTION 13931

SECTION 13932 - FIRE SUPPRESSION SYSTEM PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Above ground and underground pipe and fittings, including valves, for fire protection system described in Section 13931, Fire Suppression Sprinkler system.

1.2 RELATED SECTIONS

A. System design, regulatory requirements and Inspections: Section 13931.

B. General piping requirements: Section 15050.

C. Fire suppression system specialties: Section 13933.

D. Automatic sprinklers: Section 13934.

E. Fire pumps: Section 13920.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data:

1. Pipe and fitting materials.
2. Hangers and supports

1.4 QUALITY ASSURANCE

A. As specified in Section 13931.

PART 2 - PRODUCTS

2.1 ABOVE GROUND PIPE, VALVES AND FITTINGS

A. Pipe and fittings: Schedule 40 black steel, conforming to the requirements of NFPA 13, Installation of Sprinkler Systems, and NFPA 14, Installation of Standpipe and Hose Systems, threaded or grooved.

B. Hangers and supports: Supporting piping from above, black steel conforming to NFPA 13.

C. Valves:

1. Nibco F-607-OTS, or approved equal, 2.5-inch through 12-inch iron-body gate valve, OS&Y bolted bonnet, solid wedge, 175 pound WWP.

2. Nibco Fig. No. LD3510-8, or approved equal, 2-inch through 12-inch, lug type butterfly valve with gear operator, two factory-mounted internal supervisory switches, wheel and flag, 250 psi non-shock cold water.

PART 3 - EXECUTION

3.1 ABOVE GROUND INSTALLATION

A. Install piping above the finished ceiling wherever ceilings occur. For bar joist construction, run the pipes between or threaded through bar joists, arranged so as to give clear path for ductwork, lighting fixtures, and appurtenances below joists and to permit all possible clearance for future re-location of light fixtures and ductwork. Consult Finish Schedules on Contract drawings. Do not install piping so that it blocks access doors or panels of ductwork, air handling equipment, or the space required for filter removal.

1. Hanger spacing shall conform to NFPA 13.

B. System drains shall be piped to drain into service sinks, drains, or through wall to grade with all exterior fittings of brass. At low points in piping provide ball valves with hose nipples with vacuum breakers.

1. Except as shown otherwise on drawings, drains 1.5 inch and larger shall be piped through wall to grade.

C. Do not cut existing structural components for passage of sprinkler pipes.

END OF SECTION 13932

SECTION 13933 - FIRE SUPPRESSION SYSTEM SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire specialties.

1.2 RELATED SECTIONS

A. Basic piping requirements: Section 15050.

B. System design, regulatory requirements, and inspections: Section 13931.

C. Fire suppression system piping: Section 13932.

D. Automatic sprinklers: Section 13934.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: For each specialty included in the work. Include electrical data for products with electrical characteristics.

1.4 QUALITY ASSURANCE

A. As specified in Section 13931.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flow switches: Notifier Corp., Model WFD, or approved equal, with adjustable pneumatic retard, two SPDT switches.

B. Pressure gauges: Shall have 4.5 inch dials graduated 0 to 200 psi.

C. Monitor switch: Grinnell, Model F640, or approved equal. For valves with monitor switches 2.5 inch and smaller, Contractor has the option to use Milwaukee Valve Co. Model BB-SC, or approved equal, slow close butterfly valves with built-in monitor switches.

D. Water solenoid valve: Normally closed type, one NPT, one inch orifice, PTFE seal, 120 volt coil, Automatic Switch Co., ASCO 8210D4, or approved equal.

E. Metal signs: As required by and manufactured to meet Standard No. 13 of N.B.F.U. andOSHA specifications.

F. Indicator for inspector's test: visual.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pressure gauge with shutoff valve where indicated on drawings. Gauges shall have shutoff valve in connection. Connection to system shall be 0.5 inch with 0.5 inch by 0.25 inch reducer for gauge.

B. Install a monitoring switch on each shutoff valve installed in the fire suppression system piping.

C. Remove existing escutcheons from fire department connections and install new escutcheons, permanently fixed in place.

D. Metal signs: Provide for all main valves, riser valves, drain valves, auxiliary drain, and test valves of the system. Attach with brass chains.

E. In fire rated assemblies and in floors, install fire and smoke barrier sealants in accordance with the manufacture's requirements to meet the rating of the assembly and in compliance with Section 07840, Firestopping.

END OF SECTION 13933

SECTION 13934 - AUTOMATIC SPRINKLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sprinklers and accessories.

1.2 RELATED SECTIONS

A. System design, regulatory requirements, and inspections: Section 13931.

B. Fire suppression system piping: Section 13932.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data:

1. Each type of sprinkler included.
2. Heat deflectors and guards
3. Cabinet for sprinklers

1.4 QUALITY ASSURANCE

A. As specified in Section 13931.

1.5 EXTRA STOCK/SPARE PARTS

A. Spare sprinklers and links as required by NFPA 13.

B. One wrench for each type sprinkler.

C. Storage cabinet for spare sprinklers and links.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Sprinklers and escutcheons: Types as listed for various locations in Part 3 below.

B. All sprinklers shall be standard or quick-response type, as indicated on the drawings, complying with UL 1767.

C. Where required by the NFPA 13, and in elevator shaft and machine room, provide high-temperature links.

D. Finish: Brass for all sprinkler types.

2.2 ACCESSORIES

A. Provide wire cage guards on all new and existing sprinklers.

B. Sprinkler cabinet: As required by NFPA 13.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In suspended acoustical ceilings, locate sprinklers no less than 6 inches from edge of acoustical panel.

B. Securely mount spare sprinkler cabinet to wall at location shown on the drawings.

3.2 SCHEDULE OF LOCATIONS

A. Install types of sprinklers at locations as listed below.

TYPE	AREA
Upright	Without Ceiling
Concealed	With Ceiling
Provide guards	All New and Existing Sprinklers in 7th Floor Mechanical Room
Sidewall	Where noted

END OF SECTION 13934

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic material and equipment required for the fire protection, HVAC and plumbing piping work as indicated on the drawings.

B. Other requirements applicable to more than one Section of Division 15.

1.2 RELATED SECTIONS

A. Operating manuals: Division 1.

B. Painting: Section 09900.

1.3 DESIGN REQUIREMENTS

A. The contract drawings are generally diagrammatic, and do not indicate all fittings or offsets in pipe or all access panels, or other specialties required.

1. Install pipe exposed to view parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.
2. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.
3. No pipe shall be run below the head of window or door.
4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.4 SUBMITTALS

A. Comply with Section 01000.

B. Shop drawings:

1. Showing proposed expansion design.
2. Schedule of welding and brazing procedures proposed for each piping system included in the project.

C. Coordination drawings: Scale: 1/4"=1'-0", detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance, and Architect's lockout/tagout procedures.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

D. Product data: Identification materials and products.

E. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in "Quality Assurance" below.

1.5 QUALITY ASSURANCE

A. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

B. Welding, brazing, and soldering procedures and operator qualifications for building systems piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.
3. Copper Development Association "Copper Tube Handbook."
4. Safe Drinking Water Act.

C. Welding and brazing procedures and operator qualifications, and testing procedures and personnel qualifications, for steam piping systems operating at 250 degrees F and higher or 15 psig and higher, and water piping systems operating at 250 degrees F and higher or 160 psig and higher, and for welding pressure vessels:

1. ASME Boiler and Pressure Vessel Code (BPVC):

a. Section II Part C, Welding Rods, Electrodes, and Filler Metals.
b. Section V, Nondestructive Examination.
c. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

2. ASME B31.1, Power Piping.

D. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.
2. Nondestructive evaluation personnel: American Society for Nondestructive Testing Recommended Practice.

E. All electrical control panels, equipment, materials and devices provided or installed as work of Divisions 13 or 15 shall bear label certifying that it is tested and listed by an independent, nationally recognized testing and labeling authority. If label is not available, the item shall be tested and labeled by a testing agency acceptable to the Architect. Provide testing, if required, without additional cost to the Government.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Divisions 13 and 15.

B. Bituminous protective coating: Coal-tar based, self-priming on steel, applied in a wet film thickness at least 20.0 mils per coat.

C. Rust-inhibitive paint: Alkyd based, formulated for corrosion protection, solids 66 percent by weight, 44 percent by volume white or gray, applied in a wet film thickness of at least 2.9 mils (0.07 mm).

D. Manufactured welding or threading connections: Fittings designed for installing branches on piping, with either welded or threaded connection to branch; conforming to ASTM A 234.

E. Solder: Free of lead, antimony and zinc. No solder containing lead is permitted.

1. Composition tin 95.5 percent, copper 4 percent, and silver 0.5 percent.
2. Tin, copper, bismuth, and silver.

F. Flux: Meeting requirements of NSF 61.

G. Pipe jointing compound:

1. Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."
2. Pipe cement and oil.

2.2 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ANSI A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ANSI A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with white core with black outer layers, which when engraved will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass 1.5 inch (40 mm) in diameter with black filled number not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. No installation of piping , ductwork, or equipment shall proceed until Architect has approved shop drawings and coordination drawings.

B. Manufacturer's instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturer's instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturer's instructions and the drawings or specifications.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components, and easy access for Architect's lockout/tagout procedures. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

1. For each item of equipment for which lockout/tagout procedures are required for service, do not begin installation until coordination drawings for installation have been approved, as required in "Submittals" in Part 1 above.

3.2 PIPE INSTALLATION

A. Remove burrs resulting from cutting pipe or from any other operation.

B. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe jointing compound or tape on male threads only.
3. Cover exposed threads with either bituminous protective coating or rust-inhibitive paint. Apply after joints have been assembled and tested.

C. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

D. Provide for expansion and contraction of piping and connections so that no strain or breakage will occur. Provide anchors and guides of approved design for all piping where shown on drawings and where necessary to allow for proper expansion and contraction. At the time of installation, expansion loops shall be cold sprung one-half of the calculated expansion.

E. Provide for draining all parts of water piping systems and apparatus by installing a valved hose connection at every low point.

F. Black steel piping NPS 2.5 (DN 65) and larger shall be welded; NPS 2 (DN 50) and smaller shall be threaded, except as required otherwise in a particular section.

G. Welding and brazing:

1. Before beginning welding or brazing, obtain burning permit. Apply for permit at least 24 hours before work is scheduled. Perform welding and brazing only in areas designated on the approved permit. Provide fire watch, protection, and extinguishers as specified in Division 1.
2. Do not weld galvanized piping.
3. Use welding fittings, tees, wyes, reducers, eccentric reducers, and caps as required. Branches at least two nominal pipe sizes less than the main may be made with manufactured welding or threading connections installed with full size opening in larger pipe and in accordance with manufacturer's printed instructions. Flanges shall be welding neck or slip-on pattern of class to suit the valves or equipment connections. Flanges shall have machine bolts with hex nuts and washers.

H. Each runout to risers or equipment shall contain at least three elbows or expansion joints. Runouts shall be so arranged that movement in piping due to expansion and contraction will not be transmitted to the equipment.

I. Install unions and flanges in the piping at each item of equipment, control valve, and appliance, so as to provide easy removal of the equipment, valve, or appliance, and to provide for easy removal of coils.

J. Pitch water piping so that air in the system can be properly vented. Provide stop valves where necessary to isolate parts of system for repairs without draining the entire system.

3.3 COPPER TUBING FOR WATER INSTALLATION

A. Solder joints for copper tubing shall be made with solder and flux specified in Part 2 above. Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.

B. Make flare joints in copper tubing with proper size flaring tool and in accordance with manufacturer's recommendations.

C. Provide isolation fittings between copper and steel piping to prevent electrolysis.

D. Cut pipe with a tubing cutter or fine tooth saw. Cuts made with a saw shall be true and square and the end shall be filed smooth with a fine tooth file. Remove all marks and burrs with sandpaper.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Where it is necessary to run pipes through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.

B. All waterproofing and dampproofing of the building shall be held unharmed by the installation of the work under this specification. Wherever any of the pipe has to pierce waterproofing or dampproofing, including outside walls, it shall be sealed in a manner satisfactory to the Architect and made watertight. Any waterproofing damaged or destroyed shall be rewaterproofed.

3.5 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with minimum two-inch-(50-mm)-high letters or provide identification tags. Clearly identify function, equipment served, and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage, the item being marked.

C. Piping:

1. Mark by stenciling.
2. Mark to denote service, with arrows to denote direction of flow. Apply markings near building walls where pipes enter or leave an accessible space, and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed or replaced as work of the project.
4. Mark pipe with letters of height and with colors as required by OSHA and conform to ANSI A-13.1.
5. Identify every thermometer, gauge and control device.
6. Provide valve tags for all valves except stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Stencil ductwork, after insulation is applied if required, with minimum two-inch (50-mm)-high letters, clearly identifying service (supply, return, exhaust), and arrows showing direction of flow. Mark ducts near the building walls where they enter or leave a space, and at intervals of not more than 30 feet (9 m). Identification shall be visible to a person standing on the floor.

3.6 PIPING TESTS

A. Notify all parties whose presence is necessary for the test. Notify the Architect at least five days prior to the actual test.

B. Test before pipes are concealed or insulated. Test the piping in sections as the work progresses, so as not to delay progress of the building construction. Furnish necessary pumps and gauges.

C. Conduct all piping tests before any equipment is connected that would be subject to damage from the test pressure. Replace piping or fittings found defective with new material.

D. Bracing and supporting: Adequately brace and support piping during the test, so that no movement, displacement or damage results from the application of the test pressure.

E. To test steam piping systems operating at 250 degrees F and higher or 15 psig and higher, and generator cooling water piping, employ a qualified commercial inspection and testing laboratory to conduct visual and nondestructive tests of welds in accordance with the applicable requirements of "Quality Assurance" in Part 1 above.

F. Test the piping systems for not less than four hours to fulfill the conditions in the following schedule:

SYSTEM	PSIG TEST PRESSURE	ALLOWABLE DROP	MEDIUM
Domestic Water, Cold & Hot, and Recirculated	125	None	Water
Generator Cooling Water System	125	None	Water
Sprinkler Water and Fire Line	200	None	Water
Air Conditioning Condensate Drain	4.3	None	Water
Storm	4.3	None	Water
Steam - 15 psi and below	125	None	Water
Steam - above 15 psi	200	None	Water
Steam Condensate Return	125	None	Water

3.7 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 9. Paint the items identified below to be painted. Use paint materials and systems specified in Division 9.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Mechanical rooms (including 7th floor air-handling unit area):

   a. Uninsulated steel: Piping, pumps, tanks, and vessels.
   b. Hangers and supports.
   c. Motors.

3. Piping and ductwork exposed in finished spaces, insulated and uninsulated.

D. Items not to be painted: Copper, stainless steel.

E. Paint systems in mechanical rooms: Paint piping using colors in accordance with ANSI A13.1.

1. Galvanized steel: One coat of primer recommended for galvanized surfaces, and one coat of glossy alkyd enamel.

2. Ferrous metal: One coat of primer recommended for ferrous metal, and one coat of glossy alkyd enamel.
3. Items protected with bituminous coating or rust inhibitive primer: Finish coat of compatible glossy enamel.

F. Paint systems for exposed piping and ductwork: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat, or two if required to cover, to match adjacent surfaces in color and texture.

3.8 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the mechanical systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Architect.

END OF SECTION 15050

SECTION 15052 - SLEEVES AND PLATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves and Escutcheon Plates for Piping Systems.

B. Mechanical Seals for Piping Penetrations.

1.2 RELATED SECTIONS

A. Piping materials: Section 15050.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data:

Sleeves
Plates
Sealants
Mechanical Penetration Seals

PART 2 - PRODUCTS

2.1 SLEEVES, PLATES, AND ACCESSORIES

A. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53, Type E, Grade A, plain ends.

B. Copper sleeves: Type L, ASTM B-88 hard drawn.

C. Sealing compound Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant.

D. Floor, wall and ceiling plates (escutcheons): Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast brass: Split casting, with concealed hinge and set screw.

   a. Finish: Polished chrome-plate.

4. Stamped steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.

E. Mechanical penetration seals: Modular mechanical type, consisting of interlocking synthetic links shaped to continuously fill the annular space between the pipe and wall opening. Bolt and nut fasteners for the seals shall be stainless steel for units used in penetrations below water level.

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs.

1. Exception: Where steel pipe penetrates a steel beam that is not part of a fire- or smoke-rated assembly, no sleeve is required.

B. Do not cut, drill or burn structural steel for installation of piping without specific instructions from the Architect.

C. Locations in non-fire rated construction:

1. Install steel sleeves for penetrations of steel, iron, and insulated piping.
2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.

D. Locations in floors and fire rated construction: Sleeves used in piping penetrations through fire rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Section 07840, Firestopping.

1. Where firestop assembly is listed by an independent testing agency, sleeve material shall be as directed in the listing.
2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.

E. Install sleeves through walls and partitions flush with finished surfaces.

F. Sleeves through floors shall extend 0.375 inch above top of finished floor and be finished neat and level. Sleeves through Mechanical or Equipment Room floors shall extend 1.0 inch above finished floor. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.

G. Sleeves for insulated piping with vapor barrier shall be large enough to pass piping and insulation.

H. Seal spaces between sleeves and pipe, or pipe insulation, in non-rated walls, with mineral wool.

I. Penetrations in exterior masonry or concrete walls and foundations:

1. Sleeves: Cast iron, or in cast concrete may be core drilled.

2. Above grade: Oakum and lead, or mechanical penetration seal, at outside face of wall.
3. Below grade: Mechanical penetration seal, at outside face of wall.
4. Assemble and install mechanical penetration seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

3.2 INSTALLING PLATES

A. Piping passing through interior walls, partitions, floors and ceilings in exposed locations shall be fitted with wall, floor and ceiling plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

END OF SECTION 15052

SECTION 15053 - MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unless otherwise specified in a particular section or required for a particular application, motors shall conform to the following requirements, whether factory-installed or field-installed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Temporary exterior air-handling units: Section 15722.

B. Field-erected air-handling units: Section 15723.

C. Generator: Section 16230.

D. Variable frequency drives: Section 16266.

E. Motor starters: Section 16421.

F. Motor control centers: Section 16422.

1.3 REFERENCES

A. NEMA MG 1: Motors and Generators.

B. NEMA MG 10: Energy Management Guide for Selection and Use of Polyphase Motors.

C. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.

1.4 DEFINITIONS

A. Energy efficient motor: Motor meeting the nominal and minimum efficiency levels listed for its horsepower and speed in Table 12-10 of NEMA MG 1.

B. Nominal efficiency: Efficiency as defined in Table 12-8, Efficiency Levels, in NEMA MG 1, and identified on the motor nameplate.

1.5 SUBMITTALS

A. General: Comply with Section 01000.

B. Product Data:

1. Motors and drives not provided with equipment: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lugs, and coatings.
2. Motor capacitors.

C. Wiring diagrams required for the proper installation of mechanical equipment.

D. Submit product data which verifies compliance with ASHRAE 90.1 or provide certified performance ratings by a qualified independent testing agency.

E. Certifications:

1. Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
2. Field test showing corrected power factor, if required.
3. Motors controlled by variable frequency controllers: Certification that motor is constructed for invertor drive duty from 6 to 66 Herz.

1.6 QUALITY ASSURANCE

A. Actual motor power factor shall be tested and certified by an independent testing laboratory.

B. Where power factor is field tested as required in "Power Factor" in Part 2 below, specialist performing tests shall be acceptable to the local authorities having jurisdiction.

C. UL label and local testing (if required): As specified in Section 15050, Basic Mechanical Materials and Methods.

D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.7 REGULATORY REQUIREMENTS

A. Motors shall conform to the requirements of NEMA MG1 and applicable portions of the National Electric Code (NEC, NFPA 70).

PART 2 - PRODUCTS

2.1 BASIC MOTOR REQUIREMENTS

A. Capacity: Each motor shall have sufficient capacity and torque to start, accelerate, and operate the machine it drives without exceeding the motor nameplate rating at the speed specified, or at any speed and load which may be obtained by the drive actually furnished.

B. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

C. Loads: Belt-connected motors shall be equipped with shafts and bearings designed to withstand both the normal connected loads of the drive furnished, and momentary loads imposed during acceleration.

D. Ratings: Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be based on ambient temperature of 40 degrees Centigrade.

E. Phase: Unless otherwise indicated, motors one-half horsepower and larger shall be polyphase and motors smaller than one-half horsepower shall be single-phase motors.

F. Motor construction:

1. Motors for fans, air handling units, and pumps, unless specified otherwise in the equipment section, shall be open drip-proof NEMA design B construction.
2. Motors for cooling towers, and where indicated or specified motors mounted outdoors, shall be totally enclosed, fan-cooled (TEFC) extra severe-duty. Motors outdoors inside weather-tight enclosures may be open drip-proof type.

G. Efficiency: The term "energy efficient" is defined in the article "Definitions" in Part 1 above.

1. Single-phase motors, alternating-current fractional horsepower, rated 1/20 to 1 horsepower, 250 volts or less: NEMA MG 11, types and efficiencies selected for their applications.
2. Polyphase motors, medium alternating-current, squirrel-cage, 1 to 500 horsepower, 600 volts or less: NEMA MG 10, energy efficient types selected for their application. Nominal full-load efficiencies shall meet or exceed ratings of Table 12-10 of NEMA MG 1.
3. Motors for packaged hermetic and semi-hermetic refrigeration compressors need not comply with these efficiency requirements but they shall comply with the requirements indicated for power factor and power consumption.

2.2 SINGLE-PHASE MOTORS

A. Permanent split capacitor or split phase type.

B. Bearings: Sealed, prelubricated ball-bearing type.

2.3 POLYPHASE MOTORS

A. NEMA MG1 Design B.

B. Stator: Copper windings.

C. Rotor: Squirrel cage.

D. Bearings: Double shielded, prelubricated ball bearings suitable for radial and thrust loading of connected equipment.

E. Temperature rise shall not exceed insulation rating.

F. Insulation: Class F.

G. Motors used with inrush controllers: Match wiring requirements for indicated controller with required motor leads brought to motor terminal box to suit control method.

H. Horsepower/frame relationship: NEMA Standard for T frame motors.

I. Motor frame and endshields: Cast iron.

J. Conduit box: Either steel or aluminum, diagonally split and rotatable in 90-degree increments, with grounding provision.

K. Finishes:

1. External hardware: Plated to resist corrosion.
2. External paint: Industrial enamel.

L. Nameplates: Stainless steel or aluminum, and stamped in accordance with NEMA MG1. Nameplate information shall include the nominal efficiency value in accordance with NEMA MG1 and the manufacturer's minimum guaranteed efficiency value.

2.4 TOTALLY ENCLOSED FAN-COOLED (TEFC) MOTORS

A. Polyphase motors with the following additional requirements:

1. TEFC construction for severe environment.
2. Ventilating fans: Made of corrosion-resistant, non-sparking material.
3. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
4. Motor shaft shall be provided with an external slinger on the drive end.
5. Rotor and stator air gap surfaces coated to prevent corrosion.
6. Finish: At least two coats of catalyzed epoxy enamel.

2.5 MOTORS CONTROLLED BY VARIABLE FREQUENCY CONTROLLERS

A. Specifically constructed and warranted by the manufacturer to meet the voltage requirements of NEMA MG 1 Part 31.4.4.2.

B. Temperature rise: Match rating for Class B insulation.

C. Insulation: Class B or F (TEFC), or Class F (ODP).

2.6 MOTOR DRIVES

A. Motors for belt-driven units shall have adjustable variable pitched cast iron sheaves to allow a 10 percent increase or reduction in speed for units less than 30 HP and fixed sheaves for

units 30 HP and larger. Belts shall be sized for minimum 150 percent BHP. Provide OSHA and MOSHA approved type belt guards. Include one change in drive sheave for each unit if necessary to obtain required air quantities and static pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount direct-connected motors securely and in accurate alignment. The drive shall be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

B. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

C. Provide additional drive and belt changes where required to meet requirements of testing and balancing specified in Section 15590, Testing, Adjusting and Balancing.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 15050, provide operating instructions.

END OF SECTION 15085

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:

1. Division 5 Section Metal Fabrications for materials for attaching hangers and supports to building structure.
2. Division 15 Section Mechanical Vibration Controls for vibration isolation devices.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, Guidelines on Terminology for Pipe Hangers and Supports.

1.3 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.4 SUBMITTALS

A. Product data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding certificates: Copies of certificates for welding procedures and operators.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, Welding and Brazing Qualifications.

B. Engineering responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

1. Professional engineer qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Pipe hangers, supports, and components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, metallic coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-hanger shield inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for cold piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for hot piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For trapeze or clamped system: Insert and shield cover entire circumference of pipe.
4. For clevis or band hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

D. Pipe guides and anchors: Factory-fabricated, suitable for steam piping systems, with machined, matched surfaces with factory-bonded graphite surfaces in areas in contact with pipes.

1. Types: Slide supports, guide supports, and others, heavy-duty and as shown on drawings.
2. Barrel type cradle supports: Include semicircular cradles, water-repellent-treated, ASTM C 533 Type I calcium silicate inserts, load distribution plates, segmented thrust plates, center ribs, gaskets, guide elements, stops, slide plates, bolting, finishes, and accessories.

E. Adhesive anchors: All-thread bolts with circular flat washers and hexagonal nuts embedded in epoxy adhesive, CID A-A-1924 Group II, Type A, Class I.

2.2 MISCELLANEOUS MATERIALS

A. Powder-actuated drive-pin fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-anchor fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For steam piping provide roller type supports.

B. Pipe guide and anchor installation: Secure to supporting steel framing anchored to the structure.

C. Adhesive anchors: Comply with manufacturer's installation instructions and recommendations.

D. Channel support system installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

E. Heavy-duty steel trapeze installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of various sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

F. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

G. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Load distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, Building Services Piping, is not exceeded.

L. Insulated piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping operating above ambient air temperature: Clamp may project through insulation.
   b. Piping operating below ambient air temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

4. Shield dimensions for pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN200) and larger: Include wood inserts.
6. Insert material: Length at least as long as protective shield.
7. Thermal-hanger shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT AND FLOOR MOUNTED PIPE SUPPORTS

A. Fabricate structural-steel stands to suspend equipment and floor mounted pipe from structure above or to support equipment and pipe above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15061 - CURBS AND FLASHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Curbs, rails, and flashing devices for mechanical items and equipment penetrating roof and mounted on roof.

1.2 RELATED SECTIONS

A. Curbs for rooftop packaged air-conditioning units are specified with the units.

B. Temporary exterior air-handling units: Section 15722.

C. Ductwork: Section 15815.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop drawings: Roof curbs and rails, showing compatibility with roof membrane, insulation, and slope, and configuration for the supported equipment.

1. If curbs are provided by curb manufacturer, coordinate with approved shop drawings provided as specified in related equipment sections, to determine configuration of equipment requiring curb support.

C. Product data: Each type of manufactured unit, accessory, and accessory material.

1.4 QUALITY ASSURANCE

A. Curbs and rails may be the product of the manufacturer of the equipment they support, or of a roof curb and support manufacturer, provided they meet this specification.

1.5 SEQUENCING

A. Coordinate installation of rooftop equipment and supports with roof structure and membrane. Loads and penetrations shall not exceed or damage structural capacity or weathertightness.

PART 2 - PRODUCTS

2.1 PENETRATIONS OF SINGLE PIPE OR VENT

A. Plumbing vents through flat roof: Four-pound seamless lead flashing assembly, eight-inch skirt, top counterflashing fitting, and waterproofing compound.

B. Boot for water piping through flat roof: Four-pound lead boot, eight-inch skirt; top counterflashing fitting and waterproofing compound.

C. Vents through roof from steam or steam condensate return piping, and from steam condensate receivers: Stack flashing fitting designed for threaded connection to vent pipe and extension, with integral counterflashing, painted cast iron.

2.2 PENETRATIONS OF GROUPS OF PIPES

A. Where a group of pipes penetrates the roof, provide a manufactured curb assembly. Assembly shall include curb, cover, and boots and clamps for the number of lines shown on the drawing. Curb shall be a minimum of 18-gauge galvanized steel, unitized construction with integral base plate insulated with three-pound density insulation, two inch by two inch nailer, acrylic-clad ABS plastic cover, and fastening screws. Boots shall be graduated step design EPDM rubber, with stainless-steel lock clamps.

2.3 CURBS AND RAILS

A. Fabricate each curb and rail in accordance with certified equipment drawings supplied by the equipment manufacturer, and with details on the drawings. Select style and configuration as required by roof membrane, insulation, and slope.

1. Height: At least 12 inches above top of insulation, except as otherwise shown on drawings.
2. Steel: 18 gauge, galvanized.
3. Construction: Monolithic, with all welded components, fully mitered corners, factory-attached wood nailer, and steel counterflashing.
4. Insulation: Fiberglass board, three pounds density, 1.5 inches thick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Plumbing vent shall extend eight inches above finished roof. Clamp devices shall be tightly caulked to vent. Space between vent hub and pipe shall be lightly caulked with lead to provide for movement in piping.

B. Flashing of roofing felts into clamping devices of roof drains and sleeves through roof, and flashing and counterflashing of pipe curb assemblies and of roof-mounted rails and curbs shall be compatible with roof membrane.

C. Securely attach curb to roof construction with a 6-inch wide wood frame the thickness of the roof insulation, with countersunk flat-head 0.375-inch diameter cadmium-plated through bolts with double nuts on underside. Secure curb to wood frame with chrome-plated wood screws.

1. Place bolts and screws on maximum 12-inch centers, with no fewer than two for each side of rail, curb, or frame.

D. Where dissimilar metals would come in contact with each other, coat them with bituminous protective coating or other coating compatible with adjacent materials.

END OF SECTION 15061

SECTION 15070 - MECHANICAL VIBRATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes vibration isolators, vibration isolation bases.

B. Related Sections include the following:

1. Division 15 Section Hangers and Supports for pipe hanger restraints.
2. Division 15 Section Metal Ductwork for flexible duct connectors.

1.2 SUBMITTALS

A. Product data: Indicate types, styles, materials, and finishes for each type of isolator specified. Include load deflection curves and manufacturer's installation instructions.

B. Shop drawings: Show designs and calculations, certified by a professional engineer, for the following:

1. Design calculations: Calculations for selection of vibration isolators, design of vibration isolation bases, and selection of seismic restraints.
2. Vibration isolation base details: Detail fabrication, including anchorages and attachments to the structure and to the supported equipment. Include auxiliary motor slides and rails, and base weights.
3. Schedule showing size, type, deflection, and location for each product furnished.
4. Manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and method of assembly of components. Detail bases, and show location of equipment anchoring points, coordinated with equipment manufacturer's shop drawings.

C. Maintenance data: Submit maintenance data for each type of vibration control product. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Division 1.

1.3 QUALITY ASSURANCE

A. Manufacturer's qualifications: Firms regularly engaged in manufacture of vibration control products, of type, size, and capacity required.

1. Except as otherwise indicated, obtain vibration control products from single manufacturer.
2. Engage manufacturer to provide technical supervision of installation of vibration control products.

1.4 COORDINATION

A. Coordinate layout and installation of vibration isolation and seismic-restraint devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of concrete housekeeping and vibration isolation bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Sections.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Isolator pads: Oil and water resistant and factory cut to sizes that match requirements of the equipment supported.

1. Rubber isolator pads: Elastomer (neoprene or silicone) arranged in single or multiple layers and molded with a nonslip pattern and steel baseplates of sufficient stiffness to provide uniform loading over the pad area.

B. Spring isolators: Freestanding, laterally stable, open-spring-type isolators.

1. Outside spring diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum additional travel: 50 percent of the required deflection at rated load.
3. Lateral stiffness: More than 1.2 times the rated vertical stiffness.
4. Overload capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to a 1/4-inch- (6-mm-) thick, rubber isolator pad attached to the baseplate underside. Size baseplates to limit floor loading to 100 psig (690 kPa).
6. Top plates: Provide threaded studs for fastening and leveling equipment.
7. Finishes: Manufacturer's standard corrosive-resistant finish.

C. Restrained spring isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.

1. Housing: Welded steel with resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed. Factory-drilled baseplate for bolting to structure and bonded to a 1/4-inch- (6-mm-) thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.
2. Outside spring diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum additional travel: 50 percent of the required deflection at rated load.

4. Lateral stiffness: More than 0.8 times the rated vertical stiffness.
5. Overload capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.

D. Spring hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.

1. Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
2. Outside spring diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum additional travel: 50 percent of the required deflection at rated load.
4. Elastomeric element: Molded, oil-resistant rubber or neoprene.
5. Finishes: Baked enamel for metal components. Color-code to indicate capacity range.

2.2 VIBRATION ISOLATION (INERTIA) BASES

A. Fabricated steel bases: Structural-steel bases and rails designed and fabricated by the isolation equipment manufacturer. Include equipment static loadings, power transmission, component misalignment, and cantilever loadings. Inertia bases shall be of modular design, fabricated and shipped in pieces for field installation.

1. Fabricate bases to shapes required, with welded structural-steel shapes, plates, and bars conforming to ASTM A 36 (ASTM A 36M). Include support brackets to anchor base to isolation units. Include prelocated equipment anchor bolts and auxiliary motor slide bases or rails.
2. Frame unit with minimum depth of 0.08 by longest dimension of base, but not less than 6 inches (150 mm) deep. Size frame so that weight of frame plus concrete fill will be greater than operating weight of equipment supported. Provide steel reinforcing both ways with both ends of reinforcing butt-welded to base framing.
3. Provide welded support brackets at point indicated, and anchor base frame to spring isolator unit.
4. Configure inertia bases to accommodate equipment supported.
5. Factory finish: Manufacturer's standard corrosive-resistant finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and anchor vibration-control products according to manufacturer's written instructions and authorities having jurisdiction.

B. Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.

C. Fill concrete inertia bases, after installing base frame, with 3000-psig (20.7-MPa) concrete, and trowel to a smooth, hard finish. Cast-in-place concrete is specified in Division 3.

3.2 ADJUSTING AND CLEANING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operations.

B. Adjust thrust restraints for a maximum of 1/4 inch (6 mm) of movement at start and stop.

END OF SECTION 15070

SECTION 15080 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

A. Pipe insulation: Section 15081.

B. Duct insulation: Section 15082.

C. Equipment insulation: Section 15083.

1.3 DEFINITIONS

A. Ceiling space: The space between the ceiling and the floor of an air conditioned space above.

B. Roof space: The space between the ceiling and the roof, where building insulation is located at the roof level, or the space between the ceiling and the floor of a non-air conditioned space above.

C. Attic space: The space between the ceiling and the roof, where building insulation is located at the ceiling level.

D. Air conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).

E. Concealed insulation shall include work:

1. Above ceilings.
2. In crawl spaces and tunnels.
3. Where furred in and in pipe chases.

F. Exposed insulation shall include work:

1. In all rooms and areas.

2. In mechanical equipment rooms, penthouses, or spaces.

3. In storage rooms.

1.4 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 73, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be asbestos free.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to Sections listed in Related Sections.

PART 3 - EXECUTION

Not used.

END OF SECTION 15080

SECTION 15081 - PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe insulation for the following:

1. Domestic cold water piping.
2. Steam piping.
3. Steam condensate return piping.
4. Chilled water supply and return piping.
5. Generator radiator supply and return piping.
6. Emergency generator exhaust piping.

B. Work of this section includes:

1. Insulation for new piping installed under this contract,
2. Patching existing insulation where removed to make connections to existing piping, and
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. Definitions and insulation requirements, General: Section 15080.

B. Electric heat cable (heat tracing): Section 15771.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Schedule of products: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

C. Samples required only upon request.

1.4 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.5 QUALITY ASSURANCE

A. Materials shall be asbestos-free.

B. Installers shall be mechanics skilled in this trade.

PART 2 - PRODUCTS

2.1 FIBERGLASS PIPE INSULATION

A. Fiberglass: Nominal four lb. (64 kg/m^3) density, K value of 0.22 (0.03) at 75 degrees F (23.9 degrees C) mean temperature. Operating temperature -20 TO 500 degrees F (-28.9 degrees to 260 degrees C).

B. All service jacket (ASJ): Factory applied, fire retardant vapor barrier foil/scrim/kraft jacket. All-service jacket with self-sealing lap (ASJ-SSL).

1. Tape: Matching jacket, pressure-sensitive.

C. Fittings and valves: One-piece molded polyvinyl chloride fitting covers with factory precut fiberglass inserts.

2.2 FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Flexible elastomeric insulation: Closed-cell, sponge- or expanded rubber, ASTM C 534, Type 1 tubular and Type II sheet.

B. Fitting and valve covers: Field fabricated as specified in Part 3 below.

2.3 ADHESIVES

A. Joints, fittings, and general application:

1. Fiberglass Insulation: MIL-A-3316 Class 1 for textile bonding and Class 2 for bonding to metal, Grade A.
2. Flexible elastomeric insulation: Recommended by manufacturer.

2.4 MASTICS AND COATINGS:

A. Flexible elastomeric insulation: Manufacturer's recommended latex enamel.

B. Bituminous mastic: Fed. Spec. SS-C-153, Type I.

C. Insulating and finishing cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449.

D. Vapor barrier coating:

1. On Fiberglass Insulation: Fire- and water-resistant, MIL-C-19565, Type II.
2. On Flexible Elastomeric Insulation: Two coats of latex enamel coating.

E. Finish coating for fiberglass insulation or lagging: Washable, abrasion-resistant.

2.5 LAGGING AND REINFORCING TEXTILES

A. Canvas: Eight ounces/sq. ft. (226.8g/0.09 sq. m), fire retardant treated.

B. Glass cloth and tape: MIL-C-20079. Tape: Type II, Class 3, 4.5 ounce/sq. yd. (127.6g/0.84 sq. m). Cloth: Type I, Class 1, untreated.

2.6 FASTENERS

A. Aluminum bands: 0.75 inches (19 mm) wide and 0.020 inches (0.4 mm) thick.

B. Staples: Outward clinching type, Type 304 or 316 stainless steel.

C. Pins: Serrated shaft, Type 304 or 316 stainless steel.

2.7 PROTECTIVE PIPE JACKETS

A. Bituminous: Asphalt impregnated roof felt conforming to ASTM D-250, Type II, Class A unperforated, 45 pound (2.2 kg/sq.m).

B. Canvas: Finished with lagging coating, uniform, smooth, and ready for painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install in accordance with the minimum thickness schedule at the end of this section, as modified by specifications for each location and type.

B. Fiberglass insulation: Apply insulation to a neat and smooth finish. Comply with manufacturers' recommendations and installation instructions. Butt all joints tightly and apply a brush coat of joint adhesive to all laps and joint strips. Seal or fasten laps in jacketing as specified for location, pulling jacketing tight and smooth.

C. Flexible elastomeric insulation: Apply by slipping seamless sections of tubing over the end of the piping, wherever possible. Use slit tubing only as necessary. Seal joints and slit seams with joint adhesive.

1. Fittings and valves: Field fabricated from insulation same thickness as on the piping. Use manufacturer's miter tubes and boxes and templates.

D. Tape and seal all terminations of insulation.

E. Staple, tape, or seal plastic pipe fitting covers by methods recommended by manufacturer.

F. Coordination with pipe hangers and supports:

1. For the systems listed below, insulation shall be continuous through hanger. Install insulated shield with thickness of saddle support equal, under load, to that of

adjoining insulation. Shield and saddle support are specified in Section 15060, Hangers and Supports.

Domestic cold water
Chilled water

2. For the systems listed below, insulation may be continuous through hanger, installed as above, or hanger may be sized for pipe. Butt insulation at hangers and make smooth joints fitting around the hanger.

Steam
Steam condensate return

3. For all insulated piping exterior of building heated space, insulation shall be continuous through hangers or supports.

3.2 INSTALLING INSULATION AT PENETRATIONS

A. Where the following insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications, for coordinating insulation and fire protection sealing.

Chilled Water
Storm Water
Domestic Cold Water
Air Conditioning Condensate Drain

B. Where the following piping systems pass through sleeves and openings in floors and fire rated walls, the fire barrier sealant system shall be completed, as specified in Section 07840, Firestopping, prior to application of the insulation.

Steam
Steam Condensate Return

3.3 INSTALLING CANVAS JACKET

A. Locations:

1. All pipe insulation in the Seventh floor Mechanical Room.

3.4 INSTALLING BITUMINOUS JACKET

A. Locations: Steam and steam condensate return piping, and as specified for weather protection.

B. Coat insulation with bituminous mastic and apply felt. Overlap two inches on longitudinal seams and four inches on cross-jacket seams. Tape all seams and seal with bituminous

mastic. Fasten on 12 inch centers and at all cross-jacket seams with aluminum straps. Apply a second coat of mastic to obtain a smooth surface.

3.5 INSTALLING HEATING PIPING INSULATION

A. Piping systems:

Steam,
Steam Condensate Return,
Generator Radiator Supply and Return

B. Insulation: Fiberglass pipe insulation with jacket, in accordance with minimum thickness schedule. Seal ASJ laps and staple no less than every 4 feet.

C. Fittings and valves: Cover with prefabricated fitting covers.

D. Do not cover unions and flanges, except at steam pressure stations cover with same thickness as piping.

E. Casings and headers and steam coils: Fiberglass same thickness as on adjacent piping. Finish with a layer of glass cloth embedded in two coats of lagging coating.

3.6 INSTALLING CHILLED WATER PIPING INSULATION

A. Piping systems: Insulate supply and return with fiberglass insulation in accordance with Minimum Thickness Schedule. Seal ASJ lap to form vapor barrier.

B. At all valves, flanges and fittings, and at intervals of not more than 21 feet on continuous runs of pipe, make a joint in insulation. Finish and seal ends with vapor barrier on both sides of joint.

C. Fittings, valves, and flanges: Cover with prefabricated fitting covers.

D. Casings and headers of cooling coils: Fiberglass of thickness equal to that of adjoining pipe insulation, finished with vapor barrier jacket.

E. Insulation on strainers: Removable without damage.

3.7 INSTALLING PLUMBING PIPING INSULATION

A. Piping systems: Listed in paragraph B below.

B. Insulation: Fiberglass, thickness in accordance with minimum thickness schedule.

1. Fittings, valves, and flanges: Cover with prefabricated fitting covers.
2. Seal or finish to maintain vapor barrier on the following systems:

Aboveground domestic cold water,

Air conditioning unit condensate drains,
Vertical and horizontal storm water piping and roof drain sump

3. Seal and staple ASJ: Aboveground tempered, recirculating and domestic hot water.

3.8 INSTALLING EXTERIOR PIPING INSULATION

A. Locations: Piping systems exterior of building heated space.

Steam
Steam Condensate Return
Chilled Water

1. Where indicated on the drawings, install electric heat cable before applying insulation.

B. Insulation: As specified for the same system interior, minimum thickness 2.0 inches, or 0.5 inches thicker than scheduled for interior insulation on similar system, whichever is greater.

C. Start insulation 30 inches below grade, 30 inches below roof or 30 inches inside exterior wall. Secure insulation with aluminum bands on 12 inch centers.

D. Where insulated piping is exposed to weather, apply one of the following protective jackets:

1. Over fiberglass insulation:

a. Bituminous jacket.
b. PVC jacket.

2. Over flexible elastomeric insulation: Fully adhere a layer of glass cloth to the insulation surface, with adhesive specified for elastomeric system. Apply two coats of latex enamel finish.

3.9 ABOVE GROUND, INTERIOR:

See Schedule, next page

MINIMUM THICKNESS SCHEDULE						
		PIPE SIZES				
Piping System Types	Fluid Temp. Range Degrees F.	1 inch & less	1-1/4 inch to 2 inch	2-1/2 inch to 4 inch	5 & 6 inches	8 inch and larger
Steam Up to 24 psi	201-250	1.5	1.5	2.0	2.0	2.0
Steam 25 to 60 psi	251-305	2.0	2.5	2.5	3.0	3.0
Steam 61 psi and above	306 and above	2.5	2.5	3.0	3.5	3.5
Steam Conden. Return	ANY	1.0	1.0	1.5	1.5	2.0
Chilled Water	40-55	1.5	1.5	1.5	1.5	1.5
Domestic Water	56-180	1.0	1.0	1.0	1.0	1.0
Storm Water	---	1.0	1.0	1.0	1.0	1.0
Generator radiator supply and return	100-200	1.5	1.5	1.5	1.5	2.0

END OF SECTION 15081

SECTION 15082 - DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Insulation for following Duct System:

Heating System
Cooling System
Combination Heating Cooling System
Exhaust Duct
Outside Air (Fresh Air) Duct and plenums

B. Work of this section includes:

1. Insulation for new ductwork installed under this contract.
2. Patching existing insulation where removed to make connections.
3. Patching existing insulation damaged during demolition and construction.
4. Replacing existing insulation removed, under Section 13281, Removal of Asbestos-Containing Materials, from ducts and plenums.

1.2 RELATED SECTIONS

A. Definitions of concealed, exposed, and other terms: Section 15080.

B. Acoustical duct liner: Section 15810.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

C. Samples required only upon request.

1.4 QUALITY ASSURANCE

A. Flame and smoke ratings: System, including insulation, adhesive, and covering, shall have flame-spread index of 25 or less, and smoke-developed index of 50 or less when tested in accordance with ASTM E 84 (NFPA 255).

B. All insulation and accessories shall be asbestos free.

C. Installer qualifications: Firm with at least 5 years successful installation experience with mechanical insulation. Work shall be performed by mechanics skilled in this trade.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver each material with manufacturer's stamp or label, indicating fire hazard classification, affixed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Flexible fiberglass insulation: ASTM C 553, Type I, Class B-3, K-factor of 0.27 at 75 degrees F. mean temperature, of thicknesses specified in Part 3 below, nominal density at least one pound per cubic foot, with vapor barrier jacket of heavy duty Foil-Scrim Kraft.

B. Rigid fiberglass insulation: ASTM C 612, Class 2, nominal density at least 6 pounds per cubic foot, with K-factor of 0.22 at 75 degrees F. mean temperature, of thicknesses specified in Part 3 below, with factory applied jacket composed of a reinforced white kraft and aluminum foil laminate with the white kraft facing out.

C. Canvas: Eight ounces/sq.ft., fire retardant treated. Provide washable, abrasion-resistant finish coating.

D. Adhesives: Recommended by insulation manufacturer for the application

E. Mechanical fasteners: Perforated two inches by two inches by 0.023 inch thick zinc coated steel with one inch wide by 0.023 inch thick diamond notched tongue or No. 11 gauge wire nail, complete with necessary locking plates, holding plates, fiber washers, or speed washers as required. Provide necessary neoprene rubber base adhesive, Type 3.

F. Glass cloth and tape: MIL-C-20079. Tape: Type II, Class 3, 4.5 ounces/sq.yd. Cloth: Type I, Class 1, untreated.

G. Self-adhesive tape: Manufacturer's standard tape of material matching insulation jacket, with peelable backing and pressure-sensitive adhesive.

H. Elastomeric sheet roofing:

1. Membrane: 0.045 inch thick reinforced EPDM.
2. Seaming materials: Recommended by membrane manufacturer.
3. Flexible counterflashing: Uncured EPDM, by manufacturer of roofing membrane and recommended for use with it.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions. Butt joints tightly and apply a brush coat of adhesive to laps and joint

strips. Seal laps, pulling jacketing tight and smooth. Tape joints with self-adhesive tape matching the service jacket.

B. Tape and seal terminations of insulation to prevent "dusting".

3.2 INSULATION INSIDE BUILDINGS

A. Concealed ducts: Flexible fiberglass insulation. Adhere with adhesive in sufficient quantities to prevent sagging. On ducts more than 30 inches wide, secure insulation on the underside with mechanical fasteners on 18 inch maximum centers. Butt insulation with facing overlapping at least two inches and sealed with vapor barrier adhesive. Adhesive must cover full two inch overlap to form an airtight seal. Seal breaks and punctures with vapor barrier tape and same type of adhesive.

B. Exposed ducts: Rigid fiberglass insulation, fastened with mechanical fasteners. Fasteners shall be spaced 12 inches to 18 inches on center with a minimum of two rows per side of duct. Secure insulation in place with washers firmly embedded in insulation.

1. Install corner beads on external corners.
2. Seal joints. Apply canvas jacket. Cover with two coats of finish coating, ready for painting. Fastener caps shall match the jacket.

C. For curved surfaces, such as exposed elbows, score or cut insulating board in narrow strips as necessary for snug and neat fit.

3.3 INSULATION THICKNESS

A. Outdoor air ducts: 2 inches.

B. Exhaust and pressure relief air ducts to roof ventilators or to exterior openings: 1.5 inches, starting at connection to roof curb or opening and running back to ATC dampers but not less than 10 feet.

C. Ductwork which transmits combination cooled and heated air or untempered ventilating air shall be insulated as specified below for cooling systems.

D. Cooling systems:

1. Supply air ducts: 1.5 inches. Where necessary to conceal the standing seams and reinforcing angles on exposed ducts, two inches.

Exceptions:

a. Lined or unlined supply ducts in attic spaces: Two inches.
b. Lined or insulated flexible supply ducts shall not be externally insulated where installed in:

1) Ceiling spaces of air conditioned spaces.

2) Return air plenums, whether ceiling or roof spaces, of air conditioned spaces.

c. Supply ducts, where exposed in areas they serve, shall not be insulated.

2. Return air ducts: 1.5 inches. Where necessary to conceal standing seams and reinforcing angles on exposed ducts, two inches.

Exceptions:

a. Return ducts in attic spaces: Two inches.
b. Lined or insulated flexible return ducts shall not be externally insulated except in attic spaces, where they shall be externally insulated with 1.5 inch thick insulation.
c. Return ducts in ceiling spaces of air conditioned areas shall not be insulated. Note that insulation is required for return ducts in roof spaces.
d. Return ducts, where exposed in areas they serve, shall not be insulated.
e. Return ducts in return air ceiling plenums shall not be insulated.

3. Transfer ducts shall be insulated as specified for return ducts.

E. Heating systems:

1. Supply air ducts: 1.5 inches. Where necessary to conceal the standing seams and reinforcing angles on exposed ducts, two inches.

Exceptions:

a. Supply ducts in attic spaces: Two inches.
b. Lined or insulated flexible supply ducts shall not be externally insulated, except in attic spaces.
c. Supply ducts, where exposed in areas they serve, shall not be insulated.

2. Return ducts shall not be insulated.

Exceptions:

a. Return ducts in attic spaces: Two inches.

3. Transfer ducts shall be insulated as specified for return ducts.

F. Casings and headers of reheat coils shall be insulated with the same thickness as adjacent ductwork.

3.4 INSTALLATION ON DUCTWORK EXPOSED TO WEATHER

A. Insulate all exterior ductwork, whether lined or unlined, with rigid insulation two inches thick, except do not insulate discharge ducts from exhaust fans, or outdoor air (fresh air) ducts.

B. Over standing seams and reinforcing angles, install thickness to cover protrusions at least 0.5 inch.

C. Taper insulation on top of duct from center to each side, to slope no less than one inch per foot.

D. Mechanically fasten, with washers firmly embedded in insulation. Install fasteners in rows, no more than 18 inches on centers. Install rows no more than 18 inches apart, but no fewer than two rows each on top, bottom, and each side.

E. Install corner beads on external corners.

F. Where insulated duct penetrates walls, fully flash top, bottom, and sides.

G. Finish: Cover insulated ducts with elastomeric sheet roofing membrane, fully adhered to fiberglass insulation.

1. Apply adhesive at rate recommended by membrane manufacturer, to insulation and to membrane.
2. Overlap edges and ends minimum three inches. Splice and seal in accordance with membrane manufacturer's installation instructions.
3. Roll all surfaces, following membrane manufacturer's installation instructions.

END OF SECTION 15082

SECTION 15083 - EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment insulation as scheduled at end of Section.

B. Work of this section includes:

1. Insulation for new equipment installed under this contract.
2. Patching existing insulation where removed to make connections.
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. General Information: Section 15080.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

C. Samples required only upon request.

D. Manufacturer's installation instructions and system recommendations.

1.4 QUALITY ASSURANCE

A. Flame and smoke ratings: System for heated surfaces, including insulation, adhesive, and covering, shall have flame-spread index of 25 or less, and smoke-developed index of 50 or less when tested in accordance with ASTM E 84 (NFPA 255).

B. Insulation and accessories shall be asbestos free.

C. Installer qualifications: Firm with at least 5 years successful installation experience with mechanical insulation. Work shall be performed by mechanics skilled in this trade.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver each material with manufacturer's stamp or label, indicating fire hazard classification, affixed.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. Insulation types refer to Schedule at the end of the Section. Thicknesses are scheduled.

B. Type A, insulation for heated surfaces up to 400 degrees F., flat and curved 24 inches or more in diameter: ASTM C 612, Class 1 rigid fiberglass equipment insulation, K factor 0.26 at 75 degrees F mean temperature, density 10 pounds per cubic foot. For surfaces less than 24 inches diameter, and pump casings, use segmented sections.

C. Type B, insulation for cooled surfaces: Flexible elastomeric insulation, ASTM C 534, Type II, with vapor barrier facing.

D. Type C for heated surfaces up to 1200 degrees F: Calcium silicate ASTM C 533, Type I.

E. Insulating and finishing cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449.

F. Insulation compounds: Provide adhesives, cements, sealers, mastics, and protective finishes recommended by manufacturers of insulation for each particular application.

G. Insulation accessories: Provide staples, bands, wire, wire mesh, tape, corner angles, anchors, and stud pins recommended by manufacturer of insulation for each particular application.

H. Jacket material: Pre-sized glass cloth, not less than 7.8 ounces per square yard.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Insulate equipment as specified, except equipment with factory-applied insulation. Follow manufacturer's instructions.

B. Provide removable insulation sections to cover parts of equipment which must be opened or removed periodically for maintenance, such as vessel covers, fasteners, flanges, pump casings and strainers, frames, and accessories. On large vessels, provide additional external support.

1. On hot equipment, insulate equipment surface, leaving flanges, bolts, and other accessories exposed.
2. On cold equipment, or equipment used for both heating and cooling, insulate flanges and accessories, and make insulation separately removable.

C. Maintain the integrity of vapor barriers.

D. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, or manufacturer's nameplate. Bevel edges at interruptions.

E. On breechings, install insulation on standoffs, with required air space.

3.2 INSTALLATION ON COLD SURFACES

A. Type in accordance with Equipment Insulation Schedule.

B. Cut, score, or miter insulation to fit contours of equipment. Secure with a full coating of adhesive. Provide weld pins or stick clips with washers spaced 18 inches apart. Stagger joints between layers.

C. Fill voids with small pieces of insulation applied with adhesive on all sides to maintain complete vapor barrier. Seal joints, breaks, and punctures in facing.

D. Insulation on chilled water pumps: For each pump, construct an insulated box assembly with removable cover, or access panels.

1. Size: To surround pump housing, drive shaft, and piping, including suction diffuser, and allowing clearance for draining and adjustment of pump shaft seal.
2. Construction: 18 gauge galvanized steel; formed with edge returns so that insulation is not exposed; provided with openings for drive shaft and pipes; no part resting on pump.
3. Access: Design box for disassembly or access. Provide fasteners such as clips or cam latches, so that access is possible without the use of tools.
4. Insulation: Secured to inside of box with pins and adhesive.

3.3 INSTALLATION ON HOT SURFACES

A. Type in accordance with equipment insulation schedule.

B. Cut, score, or miter insulation to fit contour of equipment and secure with 1/2 inch x 0.015 inch galvanized steel bands on 12 inch centers. Use weld pins or stick clips with washers for flat surfaces, spaced 18 inches apart. Stagger joints where possible and fill voids with insulating cement. Apply wire mesh over entire surface of equipment and corner beads to all outside corners and edges.

3.4 INSTALLING FINISHED SURFACE

A. Apply a coat of insulating cement to smooth out surface. When cement is dry apply a coating of lagging adhesive. Embed a layer of glass cloth, overlapping all seams two inches, and finish with a second coat of same adhesive.

3.5 EQUIPMENT INSULATION SCHEDULE

See Schedule, next page

EQUIPMENT	INSULATION TYPE	THICKNESS INCHES
Uninsulated Air Handling Unit Casings and Sheet Metal Plenums	B	2 layers each 0.75
Steam Flash Tanks	B	1.5
Emergency Generator Muffler and Exhaust Pipe	C	2.0

END OF SECTION 15083

SECTION 15110 - VALVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Valves for various piping systems.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 15050.

B. Piping systems: Sections 15140, 15180.

C. Access doors: Section 08315.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: For each type of valve. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

C. Maintenance data: For inclusion in operation and maintenance manual specified in Division

1. Include manufacturer's instructions for adjusting, servicing, disassembling, and repairing.

D. Valve charts: Furnish valve charts typed on 8.5 by 11-inch (216 by 279-mm) bond paper, showing locations of all manual and automatic control valves, and flow meters. Include:

1. Number
2. Location
3. Service
4. Function
5. Area Served

E. Valve numbering system shall be approved by the Owner prior to final submittal. Place one copy of approved chart in a plastic envelope and mount on wall where directed. Provide another copy for each of the Operating and Maintenance Manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.

3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES

A. Gate valves:

1. Valves 2.0 inches (DN 50) and smaller; MSS-SP-80, Class 150, bronze construction; rising stem, solid wedge, threaded ends.
2. Valves 2.5 inches (DN 65) and larger; MSS-SP-70, Class 150, IBBM, 0.S. & Y., solid wedge, bolted bonnet, flanged ends.

B. Ball valves:

1. Valves 2.0 inches (DN 50) and smaller: Class 150 SWP, bronze, two-piece body, conventional port, TFE seats and seals, stainless steel ball and stem. Extension handle for use in insulated piping, threaded ends.
2. Valves 2.5 inches (DN 65): Class 150 SWP, bronze, three-piece body, conventional port, TFE seat, stainless steel ball and stem. Extension handle for use in insulated piping; threaded ends.
3. Valves 3.0 inches (DN 80) and larger: Class 150 SWP, carbon steel body, one piece flanged construction, conventional port, stainless steel ball and stem, TFE seat and packing. Extension handle for use in insulated piping.

C. Globe valves:

1. Valves 2.0 inches (DN 50) and smaller: MSS-SP-80, Class 125, bronze, teflon seat disk, screw-in bonnet, threaded.
2. Valves 2.5 inches (DN 65) and larger: MSS-SP-85, Class 125, cast iron disk, bolted bonnet, Nibco Fig. F-718-B, flanged ends.
3. Angle type valves 2.0 inches (DN 50) and smaller: MSS-SP-80, Class 125, bronze, Teflon seat disk, screw-in bonnet, threaded ends.

D. Center-guided, spring-loaded silent action type check valves:

1. Valves 2.0 inches (DN 50) and smaller: Class 150, bronze body, Teflon disk, Teflon seat ring, stainless steel stem and spring, threaded ends.

E. Swing check valves:

1. Valves 2.0 inches (DN 50) and smaller: MSS-SP-80, Class 125, bronze, PTFE seat, renewable disks, Y pattern, horizontal swing, threaded ends.
2. Valves 2.5 inches (DN 65) and larger: Class 125, IBBM, bolted bonnet, renewable seat and disk, horizontal swing, flanged ends.

F. Balancing valves (readable circuit balancing valves): Modified Y pattern, equal percentage globe style. Each valve shall precisely measure flow, precisely balance flow, and shut off tight without drips.

1. Configuration: 0.25-inch (DN 8) threaded brass metering port with check valves and gasketed caps on each side of the valve seat; two 0.25-inch (DN 8) connections with brass plugs on the opposite side of the metering ports for use as drain connections.
2. Adjustment and indicator: Four full turns, each 360 degrees, of handwheel, with micrometer type indicator located on handwheel. Hidden memory shall provide means for locking the valve position.
3. Sizes 0.5 through 2 inches (DN 15 through 50): All metal parts bronze copper alloy.
4. Sizes 2.5 inches (DN 65) and over: Straight configuration, ductile iron valve body with bronze stem and plug disk. Include flange adapters.
5. Insulation: Valve manufacturer's pre-formed removable fiberglass insulation and PVC jacket, thickness to meet ASHRAE 90.1 requirements.

G. Balancing valves (nonreadable): Ball valves as specified, complete with masonry stop.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install valves to be readily accessible for operation and maintenance, and with ample clearance for turning handles or operators.

B. For valves in inaccessible locations, provide access doors as specified in a related section.

C. Identify valves as specified in Section 15050, Basic Mechanical Materials and Methods.

1. Provide tags for all valves except stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.
2. Provide ceiling identification tags where valves are above an accessible suspended ceiling. Number shall correspond to tag number.

3.2 INSTALLING SHUTOFF AND BALANCING VALVES

A. Install shutoff and balancing valves where indicated. Generally, install balancing valves in return lines of cooling coils and elements, and shut-off valves in supply lines.

B. Shut-off valves for water piping shall be as follows:

1. Sizes 2.0 inches (DN 50) and smaller: Ball valves.
2. Sizes 2.5 inches (DN 65) and larger: Ball valves.

C. Shutoff valves for steam and steam condensate return shall be gate or globe valves in all sizes.

D. Balancing valves (readable):

1. Valves 2.0 inches (DN 50) and smaller: Y-type globe valve.
2. Valves 2.5 inches (DN 65) and larger: Straight-pattern globe valve.

E. Balancing valves (nonreadable): Ball valves with memory stop.

3.3 INSTALLING GLOBE AND CHECK VALVES

A. Provide globe valves where indicated.

B. Provide center-guided, spring-loaded silent-action type check valves in pumped lines, lines subject to pump pressure, and vertical lines.

C. Provide swing type check valves in gravity steam return lines.

END OF SECTION 15110

SECTION 15120 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Specialties for Piping Systems.

1.2 RELATED SECTIONS

A. Piping: Sections 15155, 15140, 15180.

1.3 SUBMITTALS

A. General: Division 1.

B. Product data: For each specialty included in the work. Include rated capacities of selected equipment and manufacturer's installation instructions where applicable. Indicate materials, finishes, dimensions, required clearances, methods of assembly of components; and piping and wiring connections.

PART 2 - PRODUCTS

2.1 GASKETS AND UNIONS

A. Pipe-flange gasket materials: Suitable for chemical and thermal conditions of piping system contents; ASME B16.21, nonmetallic, flat, asbestos-free, 0.125-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.

1. Full-face type: For flat-face, Class 125, cast iron and cast bronze flanges.
2. Narrow-face type: For raised-face, Class 250, cast iron and steel flanges.

B. Unions: Hexagonal stock, with ball-and-socket joints, and metal-to-metal seating surfaces.

1. Iron: ANSI B16.39 malleable iron, Class 150, female threaded ends.
2. Copper: ASME B16.18, cast copper alloy body, solder-joint, threaded, or solder-joint and threaded ends.
3. Threaded ends: Threads conforming to ASME B1.20.1.

C. Dielectric unions:

1. General: Completely isolate dissimilar metals so that electric current is below 1.0 percent of the galvanic current which would exist with metal-to-metal contact. Gaskets approved for the medium carried by the piping system.
2. Piping 2.5 inches and smaller: Rated at 250 psi in accordance with ASTM F 492.

   a. Approved for use on water lines.
   b. Able to withstand hydrostatic test pressure of 1,000 psi at 225 degrees F.

c. Lined with an inert, non-conductive material, threaded to NPS standards with sufficient separation between pipe ends to prevent galvanic current.

3. Piping 3.0 inches and larger: half flange unions (companions), between steel body flanges and copper pipe. Include bolt insulators, and dielectric gaskets, bolts, and nuts.
4. Removable-bushing coupling: For connecting pipes of different materials and diameters, bolted couplings in stainless steel sheaths, with removable elastomeric bushings.

2.2 WATER SPECIALTIES

A. Y-Pattern strainers: 125-psig (860-kPa) working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2-inch NPS (DN65) and larger, threaded connections for 2-inch NPS (DN50) and smaller, bolted cover, perforated Type 304 stainless-steel basket, and bottom drain connection.

B. Backflow preventer: Approved in accordance with ASSE Standard No. 1013 Reduced Pressure Principle Backflow Preventers, complete with strainer, dual check valves, relief valve assembly, tri-cocks and stop valves.

C. Manual air vent: Brass bar stock needle valve with threaded nipple and cap and chain.

D. Pressure relief valves: ASME rated, NB approved, automatic reseating type conforming to ANSI Z-21.22.

1. Provide straight pressure type where installed in pipe lines and for protection of coils and cold water vessels.
2. Provide combination pressure-temperature type where installed for hot water tanks and vessels.

2.3 STEAM SPECIALTIES

A. Safety relief valves:

1. Size and capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

a. Bronze safety valves 0.5 through 2.5 inches: Cast-bronze or forged copper body, Class 250, with threaded inlet and outlet; forged copper-alloy disc; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff, factory set and sealed.
b. Cast-iron safety valves larger than 2.5 inches: Cast-iron body, Class 250; forged copper-alloy disc and nozzle; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff; raised-face flanged inlet and threaded outlet connections; factory set and sealed.

B. Steam traps:

1. Float and thermostatic traps: ASTM A 278 (ASTM A 278M), Class 30 or Class 75, cast-iron body and bolted cap; renewable, stainless-steel float mechanism with renewable, hardened stainless-steel head and seat; balanced-pressure, thermostatic air vent made with stainless-steel or monel bellows, and stainless-steel head and seat.
2. Inverted bucket traps: ASTM A 278 (ASTM A 278M), Class 125, cast-iron body and cap, pressure rated for 250 psig (1725 kPa); stainless-steel head and seat; stainless-steel valve retainer, lever, and guide pin assembly; brass or stainless-steel bucket.

   a. Accessories: Integral stainless-steel inlet strainer within trap body.

C. Air vents: Float Vents, cast-iron or brass body; seamless brass float; balanced-pressure, thermostatic bellows; replaceable stainless-steel seat, float, and head.

D. Vacuum breakers: 210-psig steam working pressure, 500 deg F maximum operating temperature, brass body and cap, Type 303 stainless-steel valve and seat. Vacuum 2 inches water-gauge required to open.

E. Y-Pattern strainers: Minimum 250-psig (1725-kPa) steam working pressure; cast-iron body conforming to ASTM A 278 (ASTM A 278M), Class 30; Grade 18-8 stainless-steel screen, 20 mesh for 2-inch NPS (DN50) and smaller, and manufacturer recommended perforations for 2-1/2-inch NPS (DN65) and larger; tapped blowoff plug. Threaded connections for 2-inch NPS (DN50) and smaller and flanged connections for 2-1/2-inch NPS (DN65) and larger.

F. Exhaust heads: CID A-A-50494 for atmospheric discharge of exhaust or vented steam.

G. Flash tanks: Vertical steel recovery vessel with ASME Code stamp, rated for 150 psig. ANSI Class 150 RF and NPT connection. Minimum 6 inches diameter. Include vertical support legs with base.

2.4 STEAM PRESSURE-REDUCING VALVES

A. Size, Capacity and Pressure Rating: Factory set for inlet and outlet pressures indicated.

B. Valve Characteristics:

1. Pressure pilot-actuated, diaphragm type, with adjustable pressure range and positive shutoff.
2. Valves shall have cast-steel body with threaded connections for valves NPS 2 (DN 50) and smaller and flanged connections for valves NPS 2-1/2 (DN 65) and larger.
3. Hardened stainless-steel trim, replaceable head and seat, main head stem guide fitted with flushing and pressure-arresting device, cover over pilot diaphragm, and non-asbestos gaskets.
4. Maximum 25 dBa during entire range of operation.

C. Muffling Orifices: Factory-fabricated muffling orifice with primary orifices in ASTM A 53 carbon steel plate and secondary orifices in AISA Type 316C stainless steel plate, welded to primary plate. Suitable for mounting between Class 150 flanges. Steam blowoff noise attenuation range to be 6 to 10 dBA. Mounting to be downstream of pressure-reducing valve. Install orifices in accordance with manufacturer recommendations.

D. Provide 2 replacement seat kits for each pressure-reducing valve.

2.5 FLEXIBLE CONNECTIONS, WATER

A. Flexible connections NPS 2 (DN 50) and smaller: Stainless steel with threaded ends in steel pipe and bronze with solder ends in copper pipe.

B. Flexible connections NPS 2.5 through 12 (DN 65 through 300): Units shall have 150 psi flanged ends with multi-layered tire cord fabric and neoprene body, and shall be complete with two 0.625-inch diameter control rods set in isolating rubber. Angular deflection shall be 15 degrees and minimum bursting pressure shall be 800 psi. Allowable movements shall be in accordance with the following:

Pipe Size NPS (DN)	Length Face to Face-Inches	Axial Compression Inches	Axial Elongation Inches	Transverse Movement Inches
2.5 (65)	4.0	0.5	0.375	0.375
3-8 (80-200)	6.0	0.75	0.5	0.5
10-12 (250-300)	8.0	1.0	0.625	0.75

C. Flexible connections for emergency generator system: Stainless-steel water braid meeting ASME Section 9 Code standards, 16 inches (406 mm) minimum length by sizes indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLING GASKETS AND UNIONS

A. Gaskets shall be installed in accordance with manufacturer's recommendations.

B. Pipe connections to fixtures, control valves, equipment and appliances shall be provided with unions or flanges so that the units may be disconnected and replaced without damage to the pipe.

C. Provide dielectric unions between copper and steel piping 0.5 inch through 2.5 inch.

D. Provide dielectric half flange unions between copper and steel in piping 3.0 inches and larger.

3.2 INSTALLING STEAM SPECIALTIES

A. Provide steam specialties for all steam and heat transfer elements indicated. Install steam drips and traps wherever condensate can collect.

B. Steam specialties shall consist of valves, strainers, traps, vacuum breakers, and appurtenances for mains, chillers, heat exchangers, air handling units, unit heaters, hot water generator, steam heating coils and heating elements.

C. Provide vacuum breakers on fast condensing equipment such as heat exchangers, hot water generators, unit heaters and steam coils.

D. All steam strainers shall have ball type blow off valves.

E. Each steam heating element, whether equipped with automatic control valves or not, shall have a hand-operated valve in supply connection and shall have thermostatic trap in return connection. For larger heating elements and coils, the valves shall be gate type, and the traps shall be F & T type. Manual air vents on steam elements shall be installed with air vent higher than top of element.

F. Install steam pressure reducing stations as indicated on the drawings, complete with shutoff valves, strainers, pressure gauges, and globe valve by-pass and as indicated.

G. Install flash tanks as indicated.

3.3 INSTALLING FLEXIBLE CONNECTIONS

A. Make connections to base-mounted pumps and to the emergency generator system with flexible connections. Piping on house side of flexible connections shall be securely anchored.

3.4 INSTALLING WATER SPECIALTIES

A. Provide specialties for each piping system and for heat transfer elements, as indicated.

B. Install valves, Y-type strainers, balancing fittings, vacuum breakers, and appurtenances for cooling coils and cooling elements.

C. Automatic fill for the hydronic water systems shall be as diagramed on the drawings. The pressure-reducing valves and pressure-relief valves shall be line size and adjusted to the pressures indicated on the drawings.

D. In hydronic systems, provide manual air vents where indicated and at each high point in piping. Provide 0.375-inch copper tubing from each vent with cap and chain.

END OF SECTION 15120

SECTION 15121 - METERS AND GAUGES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Meters and gauges for mechanical systems.

1.2 RELATED SECTIONS

A. Pipe installation and testing: Section 15050.

B. Valve tags and charts: Section 15110.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop drawings: meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

C. Product data: For each type of meter, gauge, device, and fitting specified.

1. Scale range.
2. Ratings.
3. Calibrated performance curves.

D. Show flow measurement locations on valve charts specified in Section 15110, Valves.

PART 2 - PRODUCTS

2.1 THERMOMETERS

A. General: Industrial, adjustable angle type, accurate to within plus or minus one percent of range span, black baked enamel finish, red reading mercury tube, glass or clear acrylic plastic window, dust and moisture tight, nine-inch scale opening.

1. Graduation: To the scale shown on the drawings or of a scale so that the normal working temperature of the system is near the mid-point of the scale.
2. Case: Cast aluminum.

B. Pipe-mounted thermometers: Brass well, separable sockets.

1. Where mounted in insulated piping, thermometers shall have six-inch (150-mm) stem length and sockets with 2.5-inch (64-mm) lagging extension necks. Where mounted in uninsulated piping, they shall have 3.5-inch (89-mm) stem lengths and sockets without lagging extension.

2. Where thermometer wells only are required, provide separable socket with 2.5-inch (64-mm) lagging extension, fitted with attached chain and cap.

C. Duct-mounted thermometers: Perforated aluminum stem, length maximum 24 inches (610 mm) or of length to have end of bulb near center of duct. Provide union flange fitting where stem passes through duct side or unit casing. Provide lagging extension flange on insulated ductwork.

2.2 PRESSURE GAUGES

A. Pressure gauges shall be 4.5 inch (113 mm) dial size, accurate to within plus or minus one percent of range span, silver brazed bronze bourdon-tube system, bronze movement, aluminum dial with white background, black graduations and numerals and adjustable pointer, bottom connected.

1. Those installed adjacent to pumps or in pulsating locations shall be provided with pulsating dampeners or snubbers.
2. Steam gauges shall be provided with syphon tubes.
3. Case: Cast aluminum or molded phenolic plastic.

B. Graduation: To the scale shown on drawings, or so pointer is nearly straight up at system normal working pressure.

C. Gauges shall be straight pressure type, except gauges on suction side of pumps and inlet side of suction strainers shall be compound type.

D. Gauge cock (pressure gauge isolation valve):

1. Needle valve: Brass bar stock needle valve.
2. Ball valve: Bronze, three-piece body, full port, with Type 316 stainless steel trim, 150 psi (1034 kPa) saturated steam, 600 psi (4137 kPa) non-shock cold water, oil, or gas, equal to Nibco 595.

2.3 COMBINATION PRESSURE-TEMPERATURE CONNECTIONS

A. Combination pressure-temperature connections shall have self-closing valve which will operate at a temperature up to 300 degrees F (149 degrees C). Body and cap shall be brass, and shall receive either a temperature or pressure probe. Provide with a kit including gauges and thermometers in a protective case.

PART 3 - EXECUTION

3.1 INSTALLING THERMOMETERS

A. Pipe line thermometers shall be installed as indicated on the drawings.

B. Duct thermometers for air handling units shall be located as follows, except thermometers are not required if air system is not ducted:

1. Draw-through units: (4 per unit)

   a. OA duct: rigid bulb, minus 20 to plus 130 degrees F (minus 28.9 to plus 54.4 degrees C).
   b. RA duct: rigid bulb, plus 30 to 180 degrees F (minus 1.1 to plus 82.2 degrees C).
   c. Mixed air plenum: rigid bulb, plus 30 to 180 degrees F (minus 1.1 to plus 82.2 degrees C) (on discharge side of filter).
   d. Discharge duct: rigid bulb, plus 30 to 180 degrees F (minus 1.1 to plus 82.2 degrees C).

C. Furnish and deliver to Owner at final inspection, three additional pipe line thermometers as above specified, with 6-inch (152-mm) stem lengths, for use in the thermometer wells. Ranges shall be minus 40 to plus 110 degrees F (minus 40 to 43.3 degrees C.); 20 to 120 degrees F (minus 6.7 to 48.9 degrees C.), and 50 to 550 degrees F (10 to 287.8 degrees C).

3.2 INSTALLING PRESSURE GAUGES

A. Each gauge connection shall have a gauge cock. Connections to pipe lines shall be 0.5 inch (DN 15), with 0.5 inch (DN 15) by 0.25 inch (DN 8) reducer for valve, the assembly of sufficient length to clear insulation.

B. Where gauge cocks only are called for on drawings, provide the 0.5-inch (DN 15) connections to pipe line with reducer and the gauge cock.

C. Provide one additional compound and straight pressure gauge of appropriate scale to Owner at final inspection.

3.3 INSTALLING COMBINATION PRESSURE-TEMPERATURE CONNECTIONS

A. Option: Provide combination pressure-temperature connections, complete with kits, where thermometer wells or gauge cocks only are called for on the drawings.

END OF SECTION 15121

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Domestic cold water.

1.2 RELATED SECTIONS

A. Piping materials and methods: Section 15050.

1.3 DEFINITIONS

A. Domestic water system: Potable water system for general human use, including hot and cold water supply and return.

1.4 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each type of pipe and fitting included in the project.

PART 2 - PRODUCTS

2.1 ABOVEGROUND PIPE AND FITTINGS

A. Pipe: Copper tubing, ASTM B 88, Type L, hard drawn, plain end, or roll grooved; cut grooved not permitted.

B. Fittings:

1. For plain end copper pipe: Solder joint, cast brass, ASME B16.18, or wrought copper, ASME B16.22.

C. Flanges: Bronze, solder type, ASME B16.24, Class 150.

D. Unions: Cast bronze or wrought copper with solder ends, ASME B16.18 or B16.22.

E. Dielectric pipe fittings shall comply with Section 15120.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install domestic water piping as shown on the drawings and in accordance with the provisions of Section 15050, Basic Materials and Methods.

B. Provide dielectric unions between ferrous and copper piping.

3.2 CLEANING AND TESTING PIPING SYSTEMS

A. When a domestic water loop is completed, and before strainer baskets are installed, pressure test at the pressure shown in piping test table in Section 15050, and thoroughly flush. Water piping connections for flushing shall be same size as piping being flushed or one size smaller. When a major section of the building is completed, repeat the same procedure, except that water pipe connections for washing out shall be limited to 1.5 inch. Then install strainer baskets and conduct a preliminary operation test.

3.3 FLUSHING OF DOMESTIC WATER SYSTEM

A. Flush the new domestic water piping within the building, cold, hot and return piping, before using. Unless prescribed otherwise by the County or State Health Department, the method of flushing shall be as follows:

1. Flush with clean water until no dirty water appears at the points of outlet.
2. Flush every connection in each new branch of piping, for a minimum of 15 minutes after running clean.

END OF SECTION 15140

SECTION 15155 - SANITARY AND STORM PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior sanitary piping.

B. Interior storm piping.

C. Air-conditioning unit condensate drain.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 15050

1.3 SUBMITTALS

A. General: Comply with Section 01330.

B. Product data: Each specified material and product.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.

B. Type A: cast-iron hub and spigot pipe and fittings, ASTM A 74 service class, with ASTM C 564 neoprene rubber gaskets and lubricant.

C. Type C: Pipe: Cast-iron hubless pipe, Cast Iron Soil Pipe Institute Standard 301. Neoprene gaskets: ASTM C 564. Stainless Steel: Type 304.

1. Fittings assembled with neoprene gaskets and two-piece cast iron housing clamps and stainless steel bolts and nuts, or with corrugated stainless steel shields with four or six clamps and holding bolts.

D. Type D: Copper tubing Type DWV drawn temper, ASTM B 306, with wrought copper drainage fittings, ANSI B16.29; or cast brass fittings, ANSI B16.23.

1. For air-conditioning condensate piping smaller than 1.25 inches, (30 mm) copper Type L or M is permitted. Fittings: Solder joint, cast brass ANSI B16.18, or wrought copper ANSI B16.22.

E. Type E: galvanized steel pipe - Schedule 40, ASTM A 53, Type S (seamless), Grade A with cast-iron threaded (galvanized) drainage fittings, ANSI B16.12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.

B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 15050, Basic Mechanical Materials and Methods. Materials and work shall conform to local plumbing codes and health department regulations.

C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.

D. Threaded joints: In accordance with requirements of Section 15050, Basic Mechanical Materials and Methods. Where sanitary piping is overhead of food storage, preparation, and serving areas, use litharge and glycerine pipe compound.

E. Joints in cast-iron pipe: Oakum and molten lead, thoroughly caulked and made gas and water tight. Fill joint with lead to a depth of at least one inch, and make them flush with the hub of the Pipe.

F. Make changes in direction of sanitary and storm water piping with approved sanitary fittings, "Y" branches, 1/8 or 1/16 bends. Install proper size reducing fittings in soil, waste and vent stacks where branches occur smaller than stacks.

SANITARY AND STORM PIPE INSTALLATION SCHEDULE
Contractor Has Option Where More Than One X Appears on a Line

	MATERIAL TYPE			
USE	A	C	D	E
Storm, Ceiling Space	X	X	X	X
Sanitary, Interior Exposed	X	X	X	X
Storm, Interior Exposed	X	X	X	X
Air Condition.Condensate			X	

All of the Above Subject to Local Plumbing Code and Health Department Requirements

Material Types (Refer to Part 2 - Products)

A - Cast-Iron Hub & Spigot, Lead Joint
C - Cast-Iron No Hub
D - Copper DWV
E - Galvanized DWV

END OF SECTION 15155

SECTION 15180 - HEATING AND COOLING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steam and steam condensate return.

B. Chilled water supply and return.

C. Drain and blowdown piping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Control valves: Section 15902.

B. Wells: Section 15121.

C. Pressure switches: Section 15902.

D. Flow switches: Section 15902.

1.3 RELATED SECTIONS

A. Piping materials, installation, and testing: Section 15050.

1.4 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each type of pipe and fitting included in the project.

PART 2 - PRODUCTS

2.1 PIPE AND TUBING MATERIALS

A. General: Refer to Schedule at end of Section for identifying where the following materials are used.

B. Drawn-temper copper tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

C. Annealed-temper copper tubing: ASTM B 88, Type K (ASTM B 88M, Type A).

D. Steel pipe, 2-inch NPS (DN50) and smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40.

E. Steel pipe, 2-1/2- to 12-inch NPS (DN65 to DN300): ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40 or 80.

1. Steel pipe nipples: ASTM A 733, made of ASTM A 53, Schedule 40, carbon steel, seamless for 2-inch NPS (DN50) and smaller and electric-resistance welded for 2-1/2-inch NPS (DN65) and larger.

2.2 FITTINGS

A. Cast or wrought-copper fittings: ASME B16.22.

B. Wrought-copper unions: ASME B16.22.

C. Cast-iron threaded fittings: ASME B16.4; Classes 125, 150, and 300.

D. Malleable-iron threaded fittings: ASME B16.3, Classes 150 and 300.

E. Malleable-iron unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-iron threaded flanges: ASME B16.1, Classes 125 and 250; raised ground face, bolt holes spot faced.

G. Wrought-steel welded fittings: ASTM A 234 (ASTM A 234M), Standard Weight, ANSI B16.9 butt welding type.

H. Wrought-steel flanges and flanged fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material group: 1.1.
2. End connections: Butt welding.
3. Facings: Raised face.

I. Flexible connectors: Specified in Section 15120, Piping Specialties.

2.3 JOINING MATERIALS

A. Specified in Section 15050, Basic Mechanical Materials and Methods.

B. Gasket material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.4 VALVES

A. Gate, globe, check and ball are specified in Division 15 Section Valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping as indicated on the drawings and in accordance with provisions of Section 15050 and the piping installation schedule at the end of the Section.

B. Install automatic control valves, pressure and flow switches and insertion wells provided under Automatic Temperature Controls sections, as indicated on the drawings, and in accordance with manufacturer's instructions.

C. Provide dielectric unions between steel and copper pipe.

D. Steam supply mains shall pitch down a minimum of 1.0 inch in 40 feet in direction of flow when steam and condensate flow in the same direction. Pitch down shall be 1.0 inch in 10 feet in direction of condensate flow when steam and condensate flow in opposite directions. The system shall be installed so as to be entirely free from water hammer and water pockets. Use eccentric reducers for all reductions, at nearest branch tee. Take branches to risers off top of main with tees and 45 degree elbows.

E. Steam condensate return lines shall pitch in the direction of flow a minimum of 1.0 inch in 40 feet. Take branches to risers off top or side of main.

F. All steam horizontal runouts to risers shall be pitched back toward mains a minimum of 1.0 inch in 5.0 feet.

3.2 CLEANING PIPING SYSTEMS

A. Flushing portions of the system:

1. After a piping loop has been completed and prior to the installation of strainer baskets, flush that portion of the system. Connections shall be same size as piping being flushed, or one size smaller.
2. When a major section of the building has been completed, repeat the same procedure.
3. Flushing shall remove sediment, scale, rust and other foreign substances.
4. After flushing, install strainers and pressure test system and make it tight.

See Schedule, next page

HEATING AND COOLING PIPE INSTALLATION SCHEDULE

Contractor Has Option Where More Than One X Appears on a Line

	A	B	D	E
Steam 25 psi System	X	X		
Steam 125 psi System	X	X		
Steam Condensate Return			X	
Drain and blowdown piping	X	X		X
Chilled Water	X	X		

A. 2.5 inch and larger Black Steel Welded Schedule 40 - welded or flanged fittings.
B. 2.0 inch and smaller Black Steel Threaded Schedule 40, threaded fittings, except Schedule 80 for water over 125 psi and steam over 90 psi.
D. Black Steel Schedule 80; threaded fittings 2.0 inch and smaller; welding or flanged fittings 2.5 inch and larger.
E. Copper tubing with cast or wrought fittings.

END OF SECTION 15180

SECTION 15460 - WATER SOFTENERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial water softeners.

1. Chemicals.
2. Water testing kits.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Water Softeners. Include rated capacities, operating characteristics, furnished specialties, and accessories.
2. Water testing kits.

B. Shop Drawings: For water softeners. Include plans, elevations, sections, details, and connections to piping systems.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Piping flow diagrams.

C. Manufacturer Certificates: Signed by manufacturers certifying that water softeners comply with requirements.

D. Source quality-control test reports.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals in accordance with Division 1 requirements.

G. Warranty: Special warranty specified in this Section.

H. Maintenance service agreement.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water softeners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of mineral and brine tanks.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.
d. Attrition loss of resin exceeding 3 percent per year.
e. Mineral washed out of system during service run or backwashing period.
f. Effluent turbidity greater and color darker than incoming water.

2. Commercial Water Softener, Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: Five years.
b. Brine Tanks: Five years.
c. Controls: Five years.

1.8 MAINTENANCE SERVICE

A. Maintenance: Submit four copies of manufacturer's "Agreement for Continued Service and Maintenance," before Substantial Completion, for Owner's acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing to include replacing materials and equipment. Include one-year term of agreement with option for one-year renewal.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Salt for Brine Tanks: Furnish same form as and at least four times original load, but not less than 600 lbs. Deliver on pallets according to the following:

a. Food-Grade Pellet Salt: In 40- or 50-lb (18.1- or 22.7-kg) packages.
b. Plain Pellet Salt: In 40- or 50-lb (18.1- or 22.7-kg) packages.

2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

PART 2 - PRODUCTS

2.1 COMMERCIAL WATER SOFTENERS

A. Description: Factory-assembled, vertical pressure-ion exchanger system type water softener with regenerating equipment.

1. Comply with NSF 61, "Drinking Water System Components--Health Effects."
2. Configuration: Twin unit with two mineral tanks and one brine tank.
3. Mineral Tanks: Steel, electric welded; pressure-vessel quality.

a. Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.
b. Construction: Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels."
c. Pressure Rating: 125 psig (860 kPa) minimum.
d. Wetted Components: Suitable for water temperatures from 40 to at least 120 deg F.
e. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
f. Handholes: 4 inches (102 mm) round or 4 by 6 inches (102 by 152 mm) elliptical, in top head and lower sidewall of tanks 30 inches (762 mm) and smaller in diameter.
g. Manhole: 11 by 15 inches (280 by 380 mm) in top head of tanks larger than 30 inches (762 mm) in diameter.

h. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.

i. Finish: Hot-dip galvanized on exterior and interior of tank after fabrication unless tank is stainless steel.

j. Finish: Exterior of tank spray painted with rust-resistant prime coat, 2- to 3-mil (0.051- to 0.076-mm) dry film thickness. Interior sandblasted and lined with epoxy-polyamide coating, 8- to 10-mil (0.203- to 0.254-mm) dry film thickness.

k. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.

l. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers; arranged for even flow distribution through resin bed.

m. Liner: PE, ABS, or other material suitable for potable water.

4. Flow control:

a.. The backwash flow control shall be a pressure compensating orifice capable of providing and maintaining proper backwash flows over the entire listed operating pressure range. The backwash flow control shall be easily serviced without special tools and designed so that service to the flow control can be performed without disassembly of the valve body and the sequencing controller and without disconnecting existing inlet and outlet piping connections.

5. Controls:

a. A fully integrated programmable micro-processor driven DDC (electronic) controller shall be provided. The integrated controller shall include a multi-ported pilot control valve to initiate a backwash/regeneration sequence based on a volume-based meter.

b. The electronic controller shall be designed and manufactured by same as softener manufacturer.

c. The controller shall sequence all steps of an automatic regeneration and automatically return the softener to a service or stand-by mode. The initiating time and/or volume set points shall automatically reset upon initiation of regeneration sequence.

d. In addition, same control device allows two additional methods of regeneration sequencing:

(1) Semi-automatic initiation by utilizing the regeneration button on the controller face; or

(2) Manual regeneration utilizing the dial located on the pilot assembly.

e. The controller shall be housed in a non-metallic NEMA 4X enclosure. A sealed keypad, capable of programming all controller functions, shall be

located on the face of the controller. Also included on the face shall be a fluorescent alphanumeric display capable of showing all information necessary for programming the controller and operating the softener.

f. The controller shall operate on a low voltage electrical system. The system shall be comprised of a UL approved, CSA listed 120-volt AC, 60-Hz primary/24-volt AC 50-Hz fused secondary isolation type Class 2 transformer; all required computer grade UL listed and non-shielded cable shall be provided. The entire electronic control package and its associated inputs/outputs requires 24-volts AC at 15VA.

g. The multi-ported pilot control assembly shall include a dial for visual indication of the system status; the pilot control valve shall also allow manual operation in the event of a power failure.

h. Installation of a low-voltage interconnect cable between twin units/control devices and power supply connection in a 20/240-volt ac, 47 to 63-Hz dedicated circuit with duplex receptacle shall be required by field personnel.

i. System Control - Dual Tank Systems (Alternating Operation):

(1) Volume (immediate): The system shall operate with two media tanks and a single flow sensor in the common outlet line. One tank shall be on-line, while the other is regenerated and standing by. Each tank can regenerate several times per day. The on-line media tank shall regenerate immediately upon reaching a user specified volume of treated water. Simultaneous regenerations are not possible.

j. In addition, the following features shall be provided as part of the controller:

(1) Pilot Homing Function: The controller shall be equipped with a micro-switch to sense the position of the pilot valve. The controller display shall indicate a "Call Service" condition when the pilot is out of synchonization with the controller.

(2) Multiple tank interface shall allow the user to create a network of up to two controllers. Networked controllers shall communicate regeneration schedules and on-line/standby status to prevent simultaneous regenerations from occurring.

(3) Memory back-up protection shall be provided via two methods:

(a) An internal capacitor that allows the microprocessor to store all operating parameters for a period of 24 hours.

(b) A non-volatile memory chip which retains the selected operating program and its default settings indefinitely.

(4) Totalizer: When utilized in conjunction with a compatible flow sensing device, the controller shall include a totalizer function. The totalizer value can be displayed through the controller display.

(5) Regeneration sequence timers shall be included to provide control of up to three individual regeneration cycles, each programmable from 0 to 99 minutes.

(6) Auxiliary relay shall be provided to operate a low amperage external device(s), such as indicator lamps, control relays or as a "dry" switch. The auxiliary relay activates at the beginning of any of the four operating cycles; it can produce 24-volts AC for a duration of 1 to 99 minutes (user programmable). When configured as a "dry" switch, 120-volt 5-amp loads can be switched.

(7) Remote start input shall be included to allow initiation of regeneration sequences via an external device such as a remote pushbutton, hardness monitor or other switchable device. The controller shall be programmed to require a signal of minimum duration prior to initiating regeneration.

(8) Flow Rate Indication: When utilized in conjunction with a compatible flow sensing device, the controller shall indicate the flow rate indicator. The flow rate shall be displayed through the controller display.

(9) Lockout function shall be included to prevent unauthorized personnel from altering program date.

(10) Regeneration Override: Unit shall include a function to direct pre-programmed regeneration after 3 days without input signal.

k. In addition, provide means for remote Start and Stop to initiate regeneration sequence, and relays or dry contacts for the building direct digital control system to monitor:

1) Controller failure
2) Malfunction of pilot control valve
3) Power failure

6. Flow Sensor:

a. A flow sensor package shall be provided consisting of an insertion-type Hall Effect flow transducer and an installation fitting. The fitting provided shall be compatible with the specified piping to house the sensor providing ease of removal for inspection without modification of the pipe system. A 25-foot length of cable shall be provided for direction connection to the display. The flow sensor shall provide a low voltage signal output to the controller capable of displaying both flow rate and totalization data.

b. The flow sensing package provided shall be 3-inch copper, bronze, brass pipe, Schedule 40 Brazolet, operating range -34 deg F to 100 deg F at 140 psi; 34 deg F to 140 deg F at 100 psi, flow range as scheduled.

c. The operating temperature/pressure range of measured fluid for PVC and metal pipe fittings shall be 34 deg F through 100 deg F at 140 psi max.

d. The wetted surfaces of the flow sensor shall be polypropylene, black polyvinylidene (PVDF) and titanium.

e. The flow sensor shall have an accuracy to 1 percent over full range and repeatability to +/-0.5 percent of full range.

7. Exchange Resin:

a. The ion exchange resin shall be virgin high capacity sulfonated polystyrene type, stable over the entire pH range with good resistance to bead fracture from attrition or osmotic shock.
b. Each cubic foot of resin shall be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 pounds of salt.

8. Brine System:

a. Brine tank made from glass fiber-reinforced polyester.
b. Provide a total of one brine measuring and dry salt storage tank(s) with salt platform(s).
c. Each brine maker shall be sized for at least four regenerations at full salting (15 pounds salt/cubic foot of resin). Brine dosage shall be easily adjusted between 6, 10, or 15 pounds salting per cubic foot without piping revision.
d. The brine tank shall be constructed of rigid 3/8-inch thick rotationally molded polyethylene with cover.
e. The brine tank shall be equipped with a float operated cast-iron field serviceable brine valve for automatic control of brine withdrawal and fresh water refill. The brine valve shall provide positive shut-off to prevent air from entering the system. High purity pellet type or solar salt shall be required.

9. Accessories: Factory furnished.

a. Two sample cocks and pressure gauge kits, for inlet and outlet of softener (one kit required per tank).
b. Two drains.
c. Two water conditioning cartridges.
d. One water test kit, for grains of hardness tank, EDTA method.
e. Two blocking valves kits (one required per tank).

10. Capacities, size, and characteristics of water softener system are indicated on the drawings.

2.2 SOURCE QUALITY CONTROL

A. Hydrostatically test mineral tanks before shipment to minimum of one and one-half times pressure rating.

B. Prepare test reports.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated for commercial water softeners. Refer to Division 15 Section "Basic Mechanical Materials and Methods."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevation required for proper attachment to supported equipment.

B. Cast-in-place concrete materials and placement requirements are specified in Division 3.

3.2 WATER SOFTENER INSTALLATION

A. Install commercial water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

C. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

D. Install water testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.

1. Metal general-duty valves are specified in Division 15 Section "Valves."

2. Plastic valves are specified in Division 15 Section "Domestic Water Piping."
3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

E. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Division 15 Section "Meters and Gages."

1. Exception: Water softeners with factory-installed pressure gages at locations indicated.

F. Install valved bypass water piping around water softeners.

1. Metal general-duty valves are specified in Division 15 Section "Valves."
2. Water piping is specified in Division 15 Section "Domestic Water Piping."

G. Install drains as indirect wastes to spill into open drains or over floor drains.

H. Ground equipment according to Division 16 Section "Grounding and Bonding."

I. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with salt.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D 859, "Test Method for Silica in Water."
2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D 1068, "Test Methods for Iron in Water."
4. ASTM D 1126, "Test Method for Hardness in Water."
5. ASTM D 1129, "Terminology Relating to Water."
6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners. Refer to "Project Closeout" in Section 01000."

END OF SECTION 15460

SECTION 15713 - STEAM TO STEAM GENERATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged unfired generator (heat exchanger) using steam as primary energy source.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals in accordance with Division 1 requirements.

1.4 QUALITY ASSURANCE

A. Generator shall be ASME code constructed and stamped in accordance with Section VIII, Division 1 for Unfired Steam Generators and shall be registered with the National Board of Boiler and Pressure Vessel Inspectors, and signed copy of shop inspection report shall be provided. Generator shall be built in accordance with Section VIII "Unfired Steam Generators" and shall bear the "UB" stamp.

B. Certification of factory testing including:

1. 300 psi sheet and tube test.
2. Performance start-up testing:

    a. Start-up
    b. Low water cut-off operation
    c. High source steam pressure cut-off
    d. Automatic operation of blowdown
    e. System shutdown
    f. Operation of safety alarms

PART 2 - PRODUCTS

2.1 UNFIRED STEAM GENERATORS

A. Unfired Steam Generators: Shell and U-tube type, heating steam with steam, with removable tube bundle.

1. Unfired steam generator shall be provided as a complete package ready for installation.
2. Unfired Steam Generator:

   a. All components subject to steam side, except tube bundle, shall be Type 316 stainless steel.
   b. Horizontal or vertical shell as indicated on the drawings, insulated with 3 inches of fiberglass insulation, protected by 20-gauge thick enameled steel jacket.
   c. Factory mounted on a suitable I-beam support skid which shall be permanently welded to the shell.
   d. With submerged coil bundle, arrangement triangular: 20-gauge cupro-nickel tubes expanded into a stainless steel tube sheet with cast iron heads.
   e. Provided with an electronically operated control valve to modulate the incoming (source) steam to maintain the desired output of steam pressure +/-2 psi. Control valve shall be suitable for 150 psi. Unit-furnished controls shall modulate the source steam to maintain constant the output pressure of clean steam.
   f. Factory supplied with dual float and thermostatic traps, one for the coil bundle and one for the drip before the control valve. Generator shall be provided with an incoming strainer.
   g. Provided with an ASME Code Section I pressure relief valve or valves with a capacity to relieve the total BTU of output of the generator.
   h. Provided with a vessel steam gauge with cock and pigtail siphon. Generator shall be provided with electronic level controller and feedwater solenoid valve with 5 psi maximum pressure drop. Water column shall be provided with gauge glass. Generator shall be provided with automatic total dissolved solids (TDS) blowdown system complete with manual tandem and bypass valves.
   i. Provided with DDC-control module panel with all components factory mounted, wired, piped and tested, the unit shall be shipped from the factory as a complete unit ready for installation and operation. Generator shall be provided with an integral steam separator.
   j. Unfired steam generator shall be designed for the scheduled output of clean steam at 10 psi pressure supplied by softened (cold) feed water at 55 deg F with 35 psi source steam at the control valve.

3. Makeup Water:

   a. Connect generator to feed water piping from water softeners.
   b. Softeners: Refer to Division 15 Section "Water Softener Systems".

4. Capacity: As indicated, with clean steam in shell, source steam in tubes.

5. Shell Working Pressure: 150 psig.
6. Fouling Factor: 0.0005 on both steam sides.
7. ASME code construction.
8. Controls: Refer to Division 15 Section "Controls and Instrumentation."

B. Blowdown Tank (shipped separate for field installation):

1. Vertical, cyclindrical 125 psi working pressure tank, ASME constructed and stamped. Schedule 40 galvanized steel construction, factory provided for field installation.
2. Galvanized structural steel angles for support. Bolt to concrete pad.
3. Provide connections as indicated in the piping detail on the drawings.
4. Provide cold water supply and connect to thermostatic valve to cool tank discharge to 140 deg F.
5. For insulation, refer to Division 15 Section "Pipe and Equipment Insulation."

C. Generator DDC Control Module Panel:

1. Solid state central module incorporating operating and limit functions.
2. Controller shall feature a LED display of the pressure and high and low pressure safety cut-out and alarms.
3. The module shall be housed in a NEMA 4 enclosure and operate between 32 deg F and 140 deg F ambient temperature.
4. Input power - 120V 1 phase, 60 Hz, output contacts 1 amp at 24 Vac. Building automation outputs shall be NO/NC dry contacts .5 amp maximum, non-inductive.
5. The control module features:

   a. Built in Remote Start Stop through the BAS
   b. Built in On-Off Switch
   c. Built in Alarm Horn with Alarm Silence Relay
   d. Built in Low Water Cut-off
   e. Built in Timer for Timed Blowdown
   f. Built in Relay for Water Feed
   g. Built in Operating Pressure Readout
   h. Built in High Pressure Cut-Out and Alarm
   i. Built in Low Pressure Alarm

6. Additional features include:

   a. Built in LCD display of the following Functions and Alarms:

      (1) Power On
      (2) Low Water
      (3) High Water
      (4) Water Feed
      (5) High Pressure
      (6) Low Pressure
      (7) Blow Down Operating

b. Built in contacts to notify the Building Automation System (BAS) of the following functions and alarms:

(1) Power On
(2) Low Water
(3) High Water
(4) Water Feed
(5) High Pressure
(6) Low Pressure
(7) Blow Down Operating
(8) Operating Pressure

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to start up and test equipment.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.4 DEMONSTRATION

A. Factory-authorized service representative shall train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Allow one 8-hour site visit for this service representative. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15713

SECTION 15722 - TEMPORARY EXTERIOR AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes roof-mounted, custom, factory-fabricated air-handling units with coils.

B. Related Sections: The following Sections contain requirements that relate to this section:

1. Division 16 Section Variable Frequency Drives for variable drive.
2. Division 15 Section Mechanical Insulation for field-applied equipment insulation.
3. Division 15 Section Fans.
4. Division 15 Section Filters for filters and housings not an integral part of the air-handling units specified in this Section.
5. Section 15900 for control system including airflow measuring devices.
6. Division 16 for wires, cables, conduit, boxes, wiring devices, equipment connections, disconnects, transformers and panelboards.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Specification Section 01000.

1. Product data for each air-handling unit indicated, including the following:

   a. Certified fan performance curves with system operating conditions indicated.
   b. Certified fan sound power ratings.
   c. Certified coil performance ratings with system operating conditions indicated.
   d. Certified sound attenuator ratings.
   e. Motor ratings and electrical characteristics plus motor and fan accessories.
   f. Materials, gauges, and finishes.
   g. Filters for temporary use during construction.
   h. Dampers, including housings, linkages, and operators.

2. Shop drawings from manufacturer detailing dimensions, required clearances, components, unit weight, and location and size of each field connection. Scale: 0.25 inch equals one foot.
3. Coordination drawings for air-handling units in accordance with Division 15 Section "Basic Mechanical Requirements."
4. Wiring diagrams detailing wiring for power and controls and differentiating between manufacturer-installed wiring and field-installed wiring.
5. Product certificates signed by manufacturer certifying that products comply with specified requirements, and with requirements of ASHRAE 90.1.

   Factory test reports.

6. Field quality control test reports specified in Part 3 of this Section.

Maintenance data for air-handling units for inclusion in Operating and Maintenance Manual specified in Section 01770. Also provide a separate maintenance manual, in a hard cover three-ring binder, to be installed in the unit.

1.3 QUALITY ASSURANCE

A. NFPA compliance: Air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA Standard 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): The complete air-handling unit shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

C. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

D. Make fan selections to the right of the peak static pressure point and not on any flat portion of the fan curve. Generally, fan selection shall be in the 50 percent to 80 percent range of wide open volume.

1. If it should be necessary to provide fan wheels not described in the manufacturer's standard catalog, factory test the air handling unit to determine the effect on capacities.

E. Provide four-sided, OSHA approved fan drive guards where required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver air-handling units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of structural steel support members.

1.6 EXTRA MATERIALS

A. Furnish one additional complete set of filters.

B. In addition to belts, if any, required for final adjustments during testing and balancing, furnish one additional complete set of belts.

C. Furnish one additional gasket for each sectional joint.

PART 2 - PRODUCTS

2.2 MATERIALS

A. Galvanized steel members, fabrications and assemblies: Hot-dip galvanized after fabrication, in accordance with ASTM A 123, and as specified below. Galvanizing thickness: G-90 in accordance with ASTM A 525.

B. Galvanized steel bolts, nuts, washers, and hardware: ASTM A 153.

C. Steel tubing for frame: ASTM A 500, Grade B, cold-formed carbon steel, electric resistance welded, square and rectangular type, minimum yield strength 46,00 psi.

D. Insulation: Except as further specified for particular locations, fiberglass, ASTM C 1071, Type I, flexible, nominal density two pounds per cubic foot; or Type II, rigid, nominal density three pounds per cubic foot. Surface exposed to airstream: Faced with coated fiberglass mat.

2.3 MANUFACTURED UNITS

A. Industrial quality unit designed for outdoor installation, certified and labeled as a complete unit by an independent, nationally recognized testing and labeling authority.

B. Unit shall be completely factory-assembled, -wired, and tested in one piece. Factory assembly shall include all accessories and sections as indicated on the drawings.

C. Mechanical:

1. The air-handling unit is to be shipped in more than one section. Piping shall be fabricated to accommodate the number of sections. Provide flanged connections at break points, clearly labeled for easy field connection.
2. Piping materials shall conform to the requirements of Section 15180, Heating and Cooling Piping.

2.4 CABINET CONSTRUCTION

A. Weatherproof, designed so that water will not stand on any part. Unit serial numbers shall be permanently welded into the base frame. Cabinet shall meet the requirements for Leakage Class less than 12 in accordance with ASHRAE/ANSI 111, measured in accordance with AMCA 210. Casing shall have maximum leakage of 1 percent of the design airflow at the design static pressure.

B. Base and frame: Welded tubular steel frame, supporting internal components. Floors and walls shall deflect no more than 1/200 of span at unit operating pressures.

1. Upper frame: Forming a rigid integral truss structure when assembled with the wall panels.
2. Cross flooring members: Formed from commercial-grade hot-rolled sheet steel, ASTM A 569, 11 gauge.
3. Lifting lugs: Structural steel, welded to perimeter base frame. Design: Removable; located and sized to allow rigging and handling of the unit.
4. Finish: After fabrication and welding, acid washed and coated with epoxy primer, no less than 1.5 mils thick.

C. Units shipped in multiple sections: Engineered for field assembly. Fabricate the mating upper frame of each section with a flanged perimeter, drilled with assembly connection holes and continuously gasketed.

1. Gasket: Weather-resistant, closed-cell neoprene.
2. Assembly lugs: For connecting future module, fabricated from structural steel, with appropriate assembly holes, welded to the base frame.
3. Accessories: Provide nuts, bolts, and exterior trim pieces.
4. Connection design: Provide interface configuration and devices so that factory-installed piping and wiring can be easily connected between field-connected sections.

   a. Piping: Provide flanges and unions.
   b. Wiring: Provide electrical devices.

D. Roof: Standing seam, minimum slope of 1/4 inch per foot, constructed as specified in Panels below.

E. Foundation: The unit shall be designed to be installed on steel structural supports. Welded perimeter reinforcement shall form a gasketed weathertight seal between the unit and the supports. Frame cross members shall be designed so that the perimeter of the unit overhangs the supports.

1. Gasket: Weather-resistant closed-cell neoprene, minimum tensile strength 50 psi, 25 percent compression deflection at 2-5 psi, temperature tolerance of -40 to 158 degrees F, minimum dimensions 1.5 inches wide and 0.5 inch thick.

F. Floor: Fabricated of commercial-galvanized sheet steel, ASTM A 527, 12 gauge for floor and 20 gauge for subfloor. Space between floor and subfloor: Four inches minimum, completely filled with insulation providing R value no less than 11.

1. Joints: Sealed water- and air-tight. Sealant: ASTM C 834 and Federal Specification TTS-230C, Class B.

G. Panels: Galvanized sheet steel, ASTM A 527, lock forming quality, phosphatized and prime coated before fabrication.

1. Exterior panels, roof and walls: Double-wall construction, insulated with two inches of Type II insulation, minimum R value 8.6. Exterior of double wall: 16 gauge. Interior of double wall: 22 gauge.

   a. Design: Where a panel dimension is over 48 inches, provide a structural steel reinforcement in at least one axis. Provide flanges for fastening to frame.
   b. Joints: Weathertight; recessed, coated, and covered with removable trim strip; sealed with the same sealant used for joints in floor.
   c. Exterior panels containing access doors shall have a rain drip lip over each door.

2. Prime coating: Zinc-rich epoxy primer, applied on both sides and baked on.
3. Corners: Caulked with weather-resistant sealant.

H. Access doors: Same double wall construction as panels, minimum 72 inches high, with complete perimeter gasket, and finished on inside, outside, and edges. Doors shall open against pressure.

1. Hinge: Full length piano hinge, Type 302 stainless steel.
2. Latches: Three per door.

   a. Top, middle, and bottom: Half-turn, with interior handles.

3. Gasket: Bulb type with internal aluminum clips, neoprene, rated by the manufacturer for constant exposure to temperatures from -20 degrees F to 160 degrees F.
4. Windows: Provide 12 inch x 12 inch size in access doors to each section. Glazing: Sealed glazing units with integral dessicant, both panes wire-reinforced.

I. Access Panels: Provide where indicated, in exterior walls as required to permit removal of each coil and fan, removable without damaging the unit's air leakage performance.

J. Finish: High gloss alkyd enamel specially formulated for its weathering characteristics, total thickness not less than 1.5 mils, color to be selected.

2.5 FANS SECTION

A. Fan section construction: Fan section shall be equipped with a formed steel channel base for integral mounting of fan, motor, and casing panels. The fan scroll, wheel, shaft, bearings, and motor shall be mounted on a structural steel frame with frame mounted on base with spring- type vibration isolators.

B. Fans and shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheel shall be double-width, double-inlet type with backward-curved airfoil section blades. Airfoil wheels shall be steel painted with zinc chromate primer and an enamel finish coat. Fan shaft shall be solid steel,

turned, ground, and polished. Fan wheels shall be keyed to the shaft. Fans will be controlled by variable frequency drives.

1. Blades: Hollow airfoil design, welded to the center and wheel side plates.
2. Hubs: Cast iron, or welded fabricated steel, with straight bores and keyways, screwed to the shaft with no fewer than two set screws.

C. Shaft bearings: Grease-lubricated ball or roller bearings selected for 200,000 hours average life, with grease fittings extended to an accessible location inside the fan section on the drive side.

1. Both bearings shall be the same type and have the same bore and manufacturer.
2. At least one bearing shall be fixed.
3. Rigid supports for bearings shall be removable, providing access to the wheel.

D. Housing: Steel with a structural steel frame, continuously welded construction, fixed discharge design. Fan wheel shall be removable through the inlet opening. Outlet area shall not exceed the area recommended by AMCA 99.

1. Inlet cone: Steel, precision-spun fabrication, aerodynamically matched to the wheel side plate.

E. Fan drives: Designed for a 1.4 service factor and factory-mounted with final alignment and belt adjustment made after installation.

1. Belt Drive: Motors and fan wheel pulleys shall be adjustable pitch for use with motors up to and including 15 HP and fixed pitch for use with motors larger than 15 HP.
2. Motors shall have four-sided steel belt guards.

2.6 MOTORS

A. Motors are specified in Section 15053, Motors. Variable-speed motor controllers are specified in Section 16266.

B. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

C. Motor sizes: Minimum size as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

1. Designed for 1750 rpm.
2. Brake horsepower requirement of the fans shall not exceed 90 percent of the motor horsepower.

D. Temperature rating: 90 degrees C maximum temperature rise at 40 degrees C ambient for continuous duty at full load (Class B Insulation).

E. Service factor: 1.25 for polyphase motors and 1.35 for single-phase motors.

F. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design B.

1. Bases: Adjustable.
2. Bearings: The following features are required:

   a. Ball bearings with inner and outer shaft seals.
   b. Grease lubricated.
   c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.

3. Enclosure type: The following features are required:

   a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
   b. Guarded drip-proof motors where exposed to contact by employees or building occupants.

4. Overload protection: Built-in, automatic reset, thermal overload protection.
5. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B, in Section 15085.
6. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.

G. Starters, electrical devices, and wiring: Electrical devices and connections are specified in Division 16.

2.7 FAN VIBRATION ISOLATION

A. Provide spring isolators in at least four locations, designed with steel retainer, resilient grommet, fiber-reinforced washer, and steel center support. Minimum deflection: Two inches.

B. If fan will move horizontally more than 0.25 inch during operation, provide spring type thrust restraints.

2.8 COILS

A. Testing requirements: The following factory tests are required:

1. Coil Performance Tests: Cooling and heating coils shall be factory tested for rating in accordance with ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Coil sections: Designed and constructed to facilitate removal of coil for maintenance and replacement and to assure full air flow through coils.

1. Medium- and high-pressure units shall have double gaskets between sections and coil connection penetrations through casing sealed to minimize leakage.

C. Coils, general: Drainable, rigidly supported across the full face of the coil, and pitched to allow drainage; tested to 400 psig air under water, designed to operate at 250 psig and up to 300 degrees F; Certified in accordance with ARI 410 and listed in the ARI Directory.

1. Fins: Copper, constructed from flat plate 0.01 inch thick with belled collars for tubes. Fins shall be bonded to tubes by mechanically expanding the tubes.
2. Tubes: Seamless copper, not less than 5/8 inch outer diameter. Internal tubes shall be staggered in the direction of air flow.
3. Coil casing within unit: 16 gauge, galvanized steel for steam-heating coils and Type 304 stainless steel for cooling coils which form condensate. Provide stainless steel reinforcements where fin length is more than 42 inches.
4. Headers for Water Coils: Non-ferrous, with connections for drain valve and air vent and threaded piping connections
5. Coil supports for cooling coils: Constructed of stainless steel angles.

D. Steam heating coils: Non-freeze steam distribution type, outer tube at least one inch in diameter with a 0.625-inch diameter inner distributing tube. Tubing shall be individually finned with smooth copper positive condensate drainage. Outer tube wall thickness shall not be less than 0.035 inches.

2.9 DRAIN PANS

A. For cooling coil provide drain pans as wide as the coil section and extending no less than twelve inches past the leaving face of the last coil in the bank.

B. Construction: 18 gauge Type 304 or 316 stainless steel, no less than two inches deep with a two-inch lip, minimum pitch one inch from the high point to the drain outlet.

1. Double walls, completely insulated.
2. Welded corners.

C. Configuration: Where coils are stacked, provide intermediate stainless-steel-drain pan draining into the bottom main pan. Provide main pan with a 1.25-inch drain.

D. Mount coils above lip of drain pan.

2.10 DAMPERS

A. General: Leakage rate when tested in accordance with AMCA Standard 500 - Test Method for Louvers, Dampers and Shutters, shall not exceed 4.6 cfm per square foot at 4.0 inches w.g. pressure differential. Pressure drop shall not exceed 0.125 inch wg. at 100 fpm. Blades shall be rated for a velocity of 1500 fpm without generating objectionable noise.

1. Maximum Size: 48 inches wide, 72 inches high.
2. Damper operators are specified in Division 15 Section Energy Management and Control System.

B. Blades: Opposed-blade design, except parallel-blade design when blending two adjacent air streams.

C. Construction:

1. Frame: 16 gauge extruded aluminum steel channels; side channels provided with extruded bearing holes.
2. Blades:

a. 16 gage galvanized steel, triple V-groove design, with edge seals. Vertical blades shall be suspended so that they are centered, bottom edge seals are not unduly compressed, and weight rides on the top bearing.

3. Blade end seals: Spring type, tempered stainless steel.

D. Linkage: Low operating torque type, concealed in the frame out of the air stream.

1. Bearings: Self-lubricated, delrin, contained within the quadrant clamp.
2. Drive shafts: Square, providing proper alignment and positive locking connection among the blade, axle, and linkage.

2.11 LOUVERS

A. Intake louvers, stationary drainable-blade type, contained within six-inch frame, tested in accordance with AMCA 500. Water carry-over shall not exceed 0.01 ounces of water per 15-minute period at 580 feet per minute gross area velocity. Pressure drop at the same airflow, including the bird screen, shall not exceed 0.12 inch wg. Standard 48 by 48 inch louver shall have minimum free area of 64 percent.

B. Construction:

1. Frame: Minimum 20 gauge galvanized steel channel with box flanges.
2. Blades: Minimum 20 gauge galvanized steel, leading edge rounded.

C. Accessories:

1. Drain pan: Provide below each louver, designed to remove condensation that forms on the frame.
2. Provide 0.5-inch mesh bird screen.

2.12 FILTERS SECTION

A. Air filters: Refer to Section 15861, Filters, for air filters required for air-handling units.

B. General: Filters shall comply with NFPA Standard 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

C. Filter section: Cabinet material and finish shall match the air-handling unit cabinet, with rear accessible filter media holding frames of 18 gauge steel. Section shall have access doors centered on the frame. Frames shall be designed to meet or exceed scheduled area.

D. Filters: Specified in Section 15861, Filters.

1. Filters: Two-inch-thick disposable medium efficiency type and 12-inch-thick high performance 85 percent type bag filters.

E. Filter gauge: Specified in Section 15861, Filters. Provide filter gauge at prefilter and final filter sections.

2.13 ELECTRICAL COMPONENTS

A. Provide a factory-mounted and wired electrical system as indicated on the mechanical drawings, including, but not limited to, switches, lights, receptacles, conduit, wiring, and junction boxes.

B. Electrical devices shall conform to NFPA 70 (NEC) and requirements of Division 16, Electrical.

C. Lights:

1. Provide a vaporproof, 100-watt incandescent light as indicated on drawing.

D. Wire lights, switches, and convenience outlets to the junction box for field extension.

E. If the air handling unit is shipped in more than one section, provide all wiring with junction box connections, clearly labeled and color coded for easy field connection.

2.14 FACTORY TESTS

A. If manufacturer cannot perform the specified tests at the factory, they may be performed as part of Field Quality Control specified in Part 3 below.

B. Air leakage test: Test the unit at the design operating static pressure by measuring the airflow into and out of the unit. Measure airflow with a chambered nozzle with a variable supply system, as described in AMCA 210.

1. Seal the supply and exhaust openings and the air seal at the supply fan, to isolate the high and low sides of the unit.

C. Panel deflection: Perform test with a dial indicator accurate to plus or minus 0.001 inch. The cabinet panel deflection shall not exceed 1/200 of the panel span at design operating pressures.

D. Sound test: Test the unit at the design operating pressure to assure the maximum sound power levels are as shown on the approved submittals. The results shall not exceed the levels that are stated by AMCA 303.

1. Test by the sound intensity method using finite difference approximations. Use directional precision phase matched close spaced microphones to record the sound intensity of the surfaces being tested, taken in the first six octave bands of 63 Hz through 2000 Hz (or in the "A" scale band), and then integrated over the entire area being tested to obtain the sound power level.
2. Sound intensity measurement shall be carried out under the direct supervision of an engineer factory trained by the instrument manufacturer.

E. Airflow: Perform a coil face traverse, ASHRAE TP 3359, using a rotating vane anemometer, measuring 38 velocity readings on the down stream side of a dry coil. Use a variable plug to induce the specified operating static pressure. Calculate air flow from the velocity readings corrected for air density, applying a K-factor described in ASHRAE TP 3359.

F. Fan vibration: Test fan wheel and shaft assemblies after the fan, motor, and drive assemblies have been installed in the unit. Analyze the fan with an electronic balance analyzer with a tunable filter. Take vibration measurement on each bearing housing in the horizontal, vertical and axial positions, with the filter tuned to the fan RPM. The vibration shall be less than 0.157 in/sec velocity for a centrifugal fan.

G. Run test: Test the following:

1. Fan systems.
2. Power wiring.

H. Submit written certification of tests at the time of shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of central-station air-handling units.

B. Examine rough-in for hydronic, condensate drainage piping and electrical to verify actual locations of connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Assemble and set air-handling units level and plumb on structural supports, in accordance with manufacturer's written instructions.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties.

B. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

C. Electrical connections: The following requirements apply:

1. Electrical power wiring is specified in Division 16.
2. Temperature control wiring and interlock wiring is specified in Sections 15902 and 15903.
3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's field inspection: Arrange and pay for a factory-authorized service representative to perform the following:

1. Inspect the field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
2. Prepare a written report on findings and recommended corrective actions.

3.5 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust water coil flow, with control valves to full coil flow, to indicated gpm.

B. Adjust damper linkages for proper damper operation.

C. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, and coils entering air face.

3.6 COMMISSIONING

A. Final checks before start-up: Perform the following operations and checks before start-up:

1. Remove shipping, blocking, and bracing.
2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

6. Set outside-air and return-air mixing dampers to minimum outside-air setting.
7. Install clean filters.
8. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full-open position.
9. Disable automatic temperature control operators.

B. Starting procedures for central-station air-handling units:

1. Energize motor, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.

   a. Replace fan and motor pulleys as required to achieve design conditions.

2. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 15 Section Testing, Adjusting, and Balancing for procedures for air-handling system testing, adjusting, and balancing.

END OF SECTION 15722

SECTION 15723 - FIELD-ERECTED AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Field-erected central-station air-handling unit complete with factory-fabricated, double-wall, insulated casing panels; water and steam coils; filters; fans; humidifiers; and accessories; for indoor installation.

B. Manufacturer qualifications: Air-handling manufacturer shall be regularly engaged in the design and fabrication of air-handling units for field erection, and shall have no less than 10 years experience. Contractor-designed units are not acceptable.

1.2 RELATED SECTIONS

A. Motor efficiency: Section 15053.

B. Variable-frequency drives: Section 16266, Variable-speed Motor Controllers.

C. Fans: Section 15830.

D. Filters: Section 15861.

E. Air Coils: Section 15761

F. Humidifiers: Section 15762

G. HVAC instrumentation and controls: Section 15900

1.3 SUBMITTALS

A. General: Submit each item in this Article according to Section 01000.

B. Product Data for each component of the unit specified, including the following:

1. Filters
2. Fans
3. Fan spring isolators and inertia bases.
4. Steam humidifier showing dimensions of a complete assembled unit with all accessories. Submit calculations showing that steam manifolds will provide absorption within the required maximum distance indicated on the drawings.
5. Certified heating and cooling coil-performance ratings with system operating conditions indicated.
6. Casing panels and casing accessories, including access doors and material gages and finishes.
7. Dampers, including housings and linkages.

C. Shop drawings:

1. Coordinated shop drawing, scale no smaller than 0.5 inch to 1 foot, indicating the air-handling unit, unit casing, and other unit components as indicated on the drawings. Include a cross section of each air-handling unit in the project.
2. From the unit manufacturer, detailing assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
3. Air-handling unit casing: Details, calculations, and factory test reports showing thermal break design and performance.
4. Structural steel supports, if required, for the panel-casing system, stamped and signed by a Professional Engineer registered in Washington, DC.
5. Details of heating and cooling coil rack supports, steam humidifier manifold piping arrangement, and casing concrete base.
6. Details of filters, plenum sections, fans, and other components.

D. Submit fan curves for each air-handling unit supply and return fan.

E. Product data: Independent testing agency certified reports on tests of manufacturer's regularly manufactured panels, showing that they meet the specified requirements.

1. Panel structural performance.
2. Panel acoustical performance according to ASTM C 423..

F. Qualification data: For qualified manufacturer, as required in "Section Includes" above. Submit at least 3 installations of field-erected air-handling units designed and fabricated by the manufacturer within the past 5 years, with location and name and telephone number of the owner's representative.

G. Manufacturer's written instructions for field assembly of unit casing, including cutting and sealing.

H. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

I. Maintenance data for air-handling unit to be included in the operation and maintenance manual specified in Section 01000.

J. Submit special warranties specified in "Warranty" below.

1.4 QUALITY ASSURANCE

A. Coordination: Coordinate layout and installation of air-handling unit with piping and ductwork and with other installations.

B. Unit construction and fan and coil performance shall be certified in accordance with Air Conditioning and Refrigeration Institute (ARI) 430, Standard for Central Station Air

Handling Units, and 410, Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.

C. UL label and local testing (if required): As specified in Section 15050, Basic Mechanical Materials and Methods.

D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

E. Make fan selections to the right of the peak static pressure point and not on any flat portion of the fan curve. Generally, fan selection shall be in the 50 percent to 80 percent range of wide open volume.

1. If it should be necessary to provide fan wheels not described in the manufacturer's standard catalog, factory test the air handling unit to determine the effect on capacities.

F. Provide OSHA-approved four-sided fan drive guard where required.

G. Provide OSHA-approved fan housing over unhoused plenum/plug fans.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver unit components with protective crating and covering.

B. Coordinate size and location of concrete housekeeping and panel bases. Cast anchor-bolt inserts into base.

C. Coordinate size and location of structural-steel support members required for casing support.

1.6 WARRANTY

A. Special warranty for air-handling unit: Manufacturer's approved warranty in which manufacturer agrees to repair or replace units or components that fail in materials or workmanship within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of unit or components.
b. Leakage greater than specified.
c. Condensation on exterior of casing.
d. Debris or dirt trapped in crevices of unit interior.
e. Insulation wetted in washing-down process.

2. Warranty period: Two years from date of Substantial Completion.

B. Warranty for steel unit base: If the galvanized or coated steel base should be accepted, provide manufacturer's special warranty against corrosion of any part of the base.

1. Warranty period: 15 years from date of installation.

1.7 REDUNDANT MATERIALS

A. Redundant materials shall match products installed and shall be packaged with protective coverings for storage and identified with labels describing contents.

B. Filters: One set, including prefilters and final filters, for each air-handling unit.

C. Fan belts: One set for each air-handling unit fan.

D. Sheaves: Sets as required for air balancing. Testing and balancing subcontractor shall select the sheaves.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized steel: Hot dipped, ASTM A 123/A 123M and ASTM A 153/A 153M, 0.90 oz. zinc per square foot (G90).

B. Stainless steel: Type 304.

2.2 AIR-HANDLING UNIT PANEL CASING

A. Factory-fabricated and field-assembled acoustical enclosures of no less than two-inch-thick, dual-wall, thermally broken panels with internally sealed structural steel members designed to achieve specified structural performance of panels, complete with access doors and openings for ducts.

1. Structural performance: Maximum panel deflection 1/240 of free span when enclosure is subjected to a test air pressure of 10 inches wg with no fasteners at panel joints. Tests by methods other than air pressure are not acceptable. Panel joints and frames shall be thermally broken and capable of withstanding a pressure differential of 10 inches water gauge.
2. Thermal performance:

   a. U factor no more than 0.10.
   b. Provide manufacturer's standard system of thermal break (no-through-metal) construction, including sealants and accessories, which shall prevent continuous metal contact between inside and outside of unit.
   c. Under design conditions, condensation shall not form on outside of unit.

3. Leakage: No more than 1 percent of design volume at 1.5 times the design operating pressure or 30 cfm, whichever is greater.
4. Hygienic design: Interior shall have no crevices or small spaces between members or components. Insulation shall be completely protected from moisture. Unit shall be capable of being washed down.

B. Materials:

1. Panel and access door walls and structure: Galvanized steel or aluminum exterior, stainless-steel interior, minimum thickness as follows:

   a. Walls:

      (1) Sheet steel, 18 gage exterior and 22 gage interior.
      (2) Aluminum: 0.063 inch.

   b. Stiffeners: 18 gage.
   c. Access doors: Sheet steel, 18 gage frame and 18 gage interior and exterior walls, matching materials of casing walls.
   d. Trim: 16 gage stainless steel or extruded aluminum.

2. Provide individual panel sections at coils so coils can be easily removed for future replacement.

3. Insulation: Glass fiber, minimum density three pounds per cubic foot; non-combustible as defined by NFPA 220 when tested in accordance with ASTM E 136; surface burning characteristics in accordance with ASTM E 84 flame spread 15 and smoke developed 0, K factor of 0.23 BTU/hr/sq. ft/degree F at 75 degrees F mean temperature.

4. Sealants:

   a. Panels: Single-component, non-sag, nonstaining, permanently flexible butyl rubber, FS TT-S-001657.
   b. Door frame to panels: Clear silicone rubber, MIL-A-46106 Type 1 and FS II-S-001543.

C. Construction:

1. Equipment supports or flashings, internal partitions, or other components attached to the casing shall be fastened in such a way as to maintain casing integrity, causing no air leaks or corrosion. Provide dielectric isolation when two dissimilar metals come in contact with each other. Do not bolt, screw, or weld through casing construction.
2. Unit base or sill: Extruded aluminum or stainless steel, designed to accept casing panel and to be anchored to a concrete curb as detailed on drawings, or as described in Article "Air-Handling Unit Base".
3. Doors: Prehung, 24 by 66 inches except as otherwise shown on drawings, all welded frame, constructed and insulated the same as panels. Door swing shall open against system pressure.

   a. Hinges: At least two per door, Kason 1061.
   b. Latch: Operable from both sides of door.

c. Window: Double-pane, thermally isolated, safety glass, no less than 12 by 12 inches.

d. Each door shall include a built-in static pressure probe post with cap.

4. Connections: In modules which will be air leak tested, seal every air opening, pipe sleeve, pipe and electrical chases, and drains. Provide connections with no less than 2-inch collars for attachment of the test ductwork.

2.3 AIR-HANDLING UNIT BASE

A. Anchor unit casing to concrete curb as detailed on the drawings, complete with waterproof floor system specified in Section 07181; or, as an option, construct unit on a structural metal base.

B. Structural metal base option: Structural, welded base, 6 inches maximum height, designed to distribute loads properly to suitable mountings and reinforced to support internal components without deflection or vibration, and to support the unit and installed components during rigging, handling, and operation. Provide continuous neoprene pad between base support and existing concrete floor. Provide dielectric isolation when two dissimilar metals some in contact with each other.

1. Contractor selection of the structural metal base option shall not result in any changes for the project cost or schedule.
2. Materials: All-aluminum construction is preferred, but galvanized steel will be accepted if these requirements are met:

a. Galvanized steel: Hot-dip galvanized as specified above for materials. Where components are cut or welded, or galvanizing is damaged during installation, repair with high-zinc-dust-content paint for repairing galvanized steel, complying with SSPC-Paint 20.

b. Warranty for steel base: Against corrosion of any galvanized or coated component for 15 years, as specified for special warranty in Part 1 above.

2. Floor (walking surface): Aluminum or stainless-steel plate with safety tread surface, no less than 0.125 inch (3 mm) thick, welded at all joints and to structural members.

a. Live load: Designed for no less than 100 pounds per square foot.

b. Reinforcement: Sufficient to prevent deflection.

c. Insulation: Manufacturer's standard high-density insulation applied to underside of floor, with seamless plastic vapor barrier and protective barrier of 0.04-inch-thick aluminum or 22 gauge stainless-steel sheet.

d. Fastening to floor or joining unit sections shall be accomplished by bolting through gasketed joints above the floor, or by continuous welding. Fasteners shall not penetrate the floor plate.

3. Drainage system: Base shall be designed for cleaning by washing down and for removal of condensate, each section sloped to fully drain to a minimum 1-inch NPT drain. Provide each drain with a removable cap.

4. Service openings and penetrations: Frame with a 2-inch-high perimeter barrier continuously welded to floor. Seal or close every opening and penetration.
5. Provide equipment mounted on the base with equipment bases no less than 2 inches high. Do not mount directly on floor.

2.4 EQUIPMENT SUPPORTS

A. Air-handling unit panel casings shall be furnished by the manufacturer with internally sealed structural steel frames designed to provide the specified structural performance. Provide frame supports and foundations as required for installation as shown on the drawings or as described in article "Air-Handling Unit Base."

B. Drain pans: Formed sections of 16-gauge stainless-steel sheet. Fabricate pans in sizes and shapes to collect condensate from cooling coils (including coil piping connections and return bends) and humidifiers when units are operating at maximum catalogued face velocity across cooling coil. Drain pans shall extend 4 inches upstream and 12 inches downstream of the cooling coil.

1. Double-wall construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain connections: Both ends of pan.
3. Pan-top surface coating: Elastomeric compound.
4. Units with stacked coils shall have an intermediate stainless-steel drain pan or drain trough to collect condensate from top coil.

2.5 COILS

A. In additional to the specific requirements indicated below, coils shall conform to the requirements specified in Section 15761, Air Coils.

B. Coil modules: Common or individual, stainless-steel casings for cooling and heating coils. Design and construct to facilitate removal and replacement of coil for maintenance and to assure full airflow through coils.

C. Coil support: Coil rack designed to allow each coil to be removed. Coil shall be fully enclosed inside the unit casing.

1. Coil rack and blank-off frame support: Field-fabricated from minimum 12 gauge stainless-steel angles with 4-inch by 4-inch by 1/8-inch-thick stainless-steel mounting plates top and bottom.
2. Coil blank-off panels ("safing"): Minimum 18 gauge stainless steel as detailed on the drawings. Provide insulation between safing panels at cooling coil.

D. Coil connections: Supply and return connections shall be extended and sealed through the casing wall; drain and vent connections shall be terminated inside the casing.

E. Access panels: In casing on each side of the coil module, sized and arranged to provide access to and removal of coils. Flashing shall be aluminum or stainless steel to match casing materials.

F. Coil-performance tests: Factory-test cooling and heating coils, except sprayed surface coils, for rating according to ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

2.6 FANS

A. In addition to specific items indicated, fans shall conform to the requirements specified in Section 15830, Fans.

B. Fan performance: Certified in accordance with ARI 430.

C. Fan housing: Steel, with seams continuously welded, with angle or channel side support members and motor access plates. Discharge outlet shall conform to AMCA recommended standards. Inlet shall have spun cones which shall provide streamlined air flow into fan wheel. Fan shall have hinged access door in scroll. Base-mounted centrifugal fans shall have horizontally split fan housings.

D. Bearings: Self-aligning, pillow-block regreasable ball types selected for an average life of 200,000 hours at design operating conditions. Bearings shall be provided with grease line extending to the drive side of the fan. Shafts: Steel, turned, ground and polished.

E. Fan wheels: Keyed to the shaft and designed for continuous operation at the maximum rated fan speed and motor horsepower. Fans and shafts shall be selected to operate 25 percent below the first critical speed. Fan wheels and shafts shall be statically and dynamically balanced as an assembly. Factory test the entire unit after final assembly, for vibration. Fans shall be DWDI Arrangement 3, centrifugal type with backward-inclined air foil blades or SWSI Arrangement 1 plenum plug fan as indicated on the drawings. Finish: Zinc-molybdate primer and enamel finish coat. Return air fans shall be Class II minimum assemblies. Supply air fans shall be Class III minimum assemblies.

F. Motors: Open dripproof, 1750 rpm, of current characteristics and hp as shown on drawings. Unit motors shall comply with efficiency requirements of Section 15085 and be designed to operate with variable speed controller.

G. Drive: Constant speed, direct-drive where indicated or belt-drive, with at least 2 belts, minimum service factor 2. Provide sheaves as required in "Redundant Materials" in Part 1 above for air balancing.

H. Variable speed controller: Specified in Section 16266. Coordinate to insure the fan wheel is balanced at all operating speeds. Insure that unit is free of surge or vibrations due to harmonic frequencies.

I. Vibration isolation: Fan and motor assembly shall be mounted on minimum 16 gauge galvanized steel base and internally isolated from unit casing with spring isolators with 2.5-inch static deflection and thrust restraints. SWSI fans shall be attached to the unit casing

by a flexible fabric connection as detailed on the drawings. DWDI Arrangement 3 fans shall be mounted on a concrete inertia base with spring isolators. SWSI Arrangement 1 fans shall be mounted on a structural steel base with spring isolators.

2.7 FILTERS

A. Provide temporary throwaway filters for use until filters provided under Section 15861 are installed.

B. Filter module shall include tracks for the types of prefilters and final filters scheduled in Section 15861, Filters.

1. Provide full-height access doors on both sides of module.
2. Provide 18 gauge stainless-steel "safing" block-offs as required to prevent air from bypassing filters.
3. Vertical reinforcement of filter banks shall provide rigidity.

2.8 STEAM INJECTION HUMIDIFIER

A. Furnish humidifier of size and capacity indicated on the drawings.

B. Humidifiers shall conform to the requirements specified in Section 15752, Humidifiers.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Grout: ASTM C 1107, Grade B, nonshrink, nonmetallic.

1. Characteristics include post-hardening adjusting, dry hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix: 5000-psi (34.5MPa), 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions to receive equipment, for compliance with installation tolerances and other conditions affecting performance of field-erected air-handling units.

B. Examine roughing-in of steam, hydronic, condensate-drainage piping, and electrical to verify actual locations of connections before installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES AND CURBS

A. Coordinate size of concrete housekeeping bases, inertia bases, and curbs with actual unit sizes provided. Concrete curbs shall extend past the unit panel at least 2 inches.

B. Form concrete bases with framing lumber with form-release compounds. Chamfer top edge and corners of base. Form concrete curbs for unit panels as detailed on the drawings.

C. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing units.

D. Place concrete and allow to cure before installing unit panels. Use portland cement conforming to ASTM C 150, 4000-psig (27.6-MPa) compressive strength, and normal-weight aggregate.

E. Apply waterproof flooring to unit base interior in accordance with the requirements specified in Section 07181.

3.3 INSTALLATION

A. Assemble and set air handling unit components in place as shown on drawings or on air-handling unit base support. Provide necessary additional structural members for support from above or below.

B. Panel casing: Connect sections and structural elements using thermal break sealants and accessories. Assure that assembled system has no points of continuous metal contact between inside and outside.

C. Assemble and install heating and cooling coils and coil support systems.

D. Provide duct and piping connections to units in a manner which allows access to removable panels. Piping assemblies shall be arranged to provide full clearance in front of access doors.

E. Provide connection flanges for ductwork to unit casing in a manner which maintains the structural integrity of the unit and does not interfere with removability of adjacent casing panels.

F. Assemble and mount humidifier and factory-supplied piping in humidifier module.

G. Install dielectric pipe fittings at water coil connections where dissimilar metals are joined.

H. Install filter bank complete with filter holding frames.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's field service: Engage a factory-authorized service representative to supervise and assist in the assembly of the unit in the field and participate in testing and demonstration.

B. Rig and hoist the unit as required for installation, in accordance with manufacturer's recommendations.

C. After the unit is completely assembled and before startup, the factory representative shall inspect and test it.

D. Air leakage test: In accordance with SMACNA Leakage Test Manual, performed on the assembled unit with all openings sealed and complete separation between the positive and negative pressure sides.

1. Test pressure: 6 inches wg differential pressure, positive and negative as applicable to unit parts.
2. Contractor responsibilities:

   a. No less than 14 calendar days before the test:

      (1) Submit data for the flow meter to be used in testing, either calibration data or certification showing that the meter manufacturer meets requirements of the Leakage Test Manual.
      (2) Submit properly prepared Air Leakage Test Form for each unit to be tested.

   b. Provide temporary high-pressure duct between test fan and unit.
   c. Unload, rig, and move test equipment.
   d. Install connection fittings for test.
   e. Provide 460-V, 3-phase temporary electrical power for test fan within 6 feet of fan position.
   f. Provide115-V, single-phase temporary electrical service at each unit to be tested.
   g. Remove test fan and provide rigging and loading for return to manufacturer.
   h. Miscellaneous labor and materials required to carry out testing procedures.
   i. Repair and replace malfunctioning units or components until all units are demonstrated to meet requirements.

3. Manufacturer responsibilities:

   a. Provide test fan at the project site, capable of providing the required airflow at the required positive and negative test pressures.
   b. Provide shipping for return of test fan.

E. Airflow test: Perform coil face traverse in accordance with ASHRAE 33, using a rotating-vane anemometer.

1. Take no fewer than 2 velocity readings per square foot of coil face area on the downstream side of dry coil.
2. Use a variable plug to induce the specified operating static pressure.
3. Calculate airflow from the velocity readings corrected for air density and applying a K factor as described in ASHRAE Test Procedure 3359.

F. Submit completed test reports. Manufacturer's representative shall submit written report certifying that each unit has been installed and tested and demonstrated to be in compliance with requirements.

3.5 DEMONSTRATION

A. No less than 7 calendar days before demonstration, notify Architect in writing. Demonstrate equipment in the presence of the Architect.

3.6 OPERATING INSTRUCTIONS

A. As specified in Section 15050, provide operating instructions.

B. After the first unit has been commissioned, including air balancing and operation on building DDC control, provide training classes in accordance with the requirements specified in Section 15900. Training will be required for three shifts.

END OF SECTION 15723

SECTION 15752 - HUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes provisions for dispersion tube steam humidifiers located in ductwork or air-handling units.

1.3 RELATED SECTIONS

A. Division 15 Section "Hangers and Supports."

B. Division 15 Section "Metal Ducts."

C. Division 15 Section "Instrumentation and Controls."

D. Division 15 Section "Field-Erected Air Handling Units."

1.4 SUBMITTALS

A. General: Comply with"Submittals" in Section 01000.

A. Product data: Each type of humidifier.

B. Shop drawings: Show complete dimensions of each complete assembled unit with accessories, as it is proposed to be installed.

1. For steam injection humidifiers, submit calculations showing that the manifolds will provide absorption within the required maximum distance.

C. Operating instructions: Complete operating and maintenance data to be included in the project Operation and Maintenance Manual required in Division 1.

1.5 QUALITY ASSURANCE

A. Packaged units and electrical components shall be listed and labeled in accordance with NFPA 70, Article 100, by a nationally recognized testing laboratory.

PART 2 - PRODUCTS

2.1 STEAM HUMIDIFIERS

A. Isothermic insertion steam injection humidifiers with tubes or tube panels, headers, manifolds, tubes, and orifices all Type 304 stainless steel.

B. Sizes, capacities and configurations indicated on drawings.

C. Dispersion tube type steam humidifiers:

1. Stainless steel dispersion tube assembly (single or multiple tube) complete with calibrated orifice tubes, integral stainless steel condensate drain tube and stainless steel duct mounting plate.
2. Panel dispersion type complete with stainless steel dispersion tubes spanning between two stainless-steel headers in a stainless-steel casing, complete with steam supply header/separator and condensate collection header.
3. Tubes: Fitted with two rows of steam discharge tubelets, discharging steam in opposite directions, discharge openings pointing upstream into airflow. Each tubelet shall contain steam orifices sized for its steam capacity.
4. Joints: Continuously welded.
5. Each packaged humidifier panel assembly shall be capable of stacking or end-to-end mounting in the air handler casings.
6. Provide flanged inlet at the steam supply connection to the panel.
7. Performance: Humidifier shall provide complete absorption into the air stream with no condensation on any surfaces within 24 inches downstream of the tube panel, while maintaining relative humidity at maximum 70 percent at a minimum temperature of 55 degrees F in the duct air stream.

   a. Air pressure loss across the humidifier panel shall not exceed 0.01 inch wg at duct air velocity of 500 fpm.

D. Humidifier control valve: Electrically actuated, DDC, modulating 2-way steam control or metering valve, parabolic plug type, fail closed. The control valve shall be modulated via a humidity transmitter provided by the building DDC control system.

1. Materials: Cast-iron or bronze body with Type 316 stainless-steel trim.
2. Rating: Suitable for 250 psig steam at 400 deg F.
3. Differential pressure: 2 psig minimum.

E. Components and accessories: Steam piping, inlet strainers, traps, and specialties.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify size of air-handling units and ducts before preparing shop drawings specified in Part 1 above.

3.2 INSTALLATION

A. Install humidifiers as shown on the drawings, in accordance with manufacturer's instructions, and under the supervision of the manufacturer's representative.

B. Pipe trap discharge condensate of humidifier to condensate return piping system.

C. Install control devices. Wiring, calibration, adjusting, and coordinating controls are specified with the automatic temperature control system

3.3 TESTING

A. Test and adjust each steam humidifier until vapor trail shows that absorption occurs within the required maximum distance.

3.4 DEMONSTRATION

A. Manufacturer's representative shall instruct Government's maintenance personnel in operation and maintenance of steam humidification system. Conduct demonstration and instruction using the approved Operation and Maintenance Manuals.

END OF SECTION 15752

SECTION 15761 - AIR COILS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Chilled-water coils.
2. Steam coils.

B. Related Sections include the following:

1. Division 15 section, Control Systems Equipment for coil temperature-control valve requirements.

1.2 SUBMITTALS

A. Product data: Include rated capacities of selected models; pressure drop; shipping, installed, and operating weights; installation instructions; and startup instructions for each type of product indicated.

B. Shop drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Coordination drawings: Scaled drawings, 0.5 inch equal to one foot, coordinating coil location in field-erected air-handling units.

C. Maintenance data: For air coils to include in maintenance manuals specified in Division 1.

1.3 QUALITY ASSURANCE

A. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by an independent, nationally recognized testing and labeling authority, and marked for intended use.

B. Comply with ARI 410, Standard for Forced-Circulation Air-Cooling and Air-Heating Coils, for components, construction, and rating of coils.

PART 2 - PRODUCTS

2.1 CHILLED-WATER COILS

A. Description: Self-draining coil fabricated to ARI 410.

B. Piping connections: Threaded, on same end.

C. Tubes: Seamless, copper, complying with ASTM B 75 (ASTM B 75M).

1. Tube diameter: 0.625 inch (15.9 mm).
2. Minimum tube wall thickness: 0.035 inch.

D. Fins: 0.010-inch non-lead solder-coated copper spiral fins, mechanically bonded. Fin spaces indicated on the drawings.

E. Fin and tube joint: Silver brazed.

F. Headers: Seamless copper tube with brazed joints, prime coated.

1. Connections: Two, full-sized, with supply connection on the leaving side of the coil. Equip with drain valves and air vent connections.

G. Frames and casing: 16 gauge stainless steel.

H. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.

1. Working pressure ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).

I. Source quality control: Test to 400 psig (1380 kPa) underwater.

2.2. STEAM COILS

A. Description: Distribution header coil fabricated to ARI 410, with threaded steam supply and condensate connections.

1. Connections: Same end.

B. Inner and outer tubes shall be of seamless copper.

1. Coils with finned tube length of 60 inches (1.5 m) or greater shall have minimum 1.0 inch (25 mm) outer diameter and 0.625 inch (16 mm) inner diameter tubes.
2. Coils with finned tube length less than 60 inches (1.5 m) shall have minimum 0.625 inch (16 mm) outer diameter and 0.375 inch (10 mm) inner diameter tubes.

C. Fins: 0.010-inch non-lead-solder-coated copper spiral fins, mechanically bonded. Fin spaces indicated on the drawings.

D. Fin and tube joint: Silver brazed.

E. Headers: Seamless copper tube with brazed joints, prime coated.

F. Frames and casing: Stainless-steel channel frame, 0.064 inch (1.6 mm), and stainless-steel sheet casing.

G. Ratings: Design tested and rated according to ASHRAE 33 and ARI 410.

1. Working pressure ratings: 100 psig (690 kPa), 400 deg F (204.4 deg C).

H. Source quality control: Test to 300 psig (2070 kPa), and to 200 psig (1380 kPa) underwater.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plenums and units to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in air-handling unit casings constructed according to SMACNA's HVAC Duct Construction Standards, Metal and Flexible.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Unless otherwise indicated, connect piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Straighten bent fins on each air coil.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

END OF SECTION 15761

SECTION 15771 - ELECTRIC HEAT TRACING CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electric heat tracing cable for protecting piping from freezing.

1.2 REFERENCES

A. National Electric Code, Section 427, Fixed Electric Heating Equipment for Pipelines and Vessels.

1.3 SUBMITTALS

A. General: Comply with Division 1.

B. Product data: Heat tracing cable and accessories.

PART 2 - PRODUCTS

2.1 ELECTRIC HEAT TRACING SYSTEMS

A. Provide tracing for outdoor winterized piping indicated on the drawings and listed in Part 3 below. Systems shall meet requirements of the National Electrical Code (NEC) (NFPA 70), Section 427.

B. Heating cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed to be cut to length at the job site and for wrapping around valves or complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.

1. Provide end seals for ends of circuits. Wires at the ends of circuits shall not be tied together.
2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 36 degrees F (4 degrees C) minimum during winter outdoor design temperature, but not less than the following:

   a. NPS 3 (DN 75) pipe and smaller (with 2-inch (50-mm) insulation): 4 watts per foot of pipe.
   b. NPS 4 (DN 100) pipe and larger (with 2-inch (50-mm) insulation): 8 watts per foot of pipe.

C. Electrical heat tracing accessories:

1. Power supply connection fittings and stainless steel mounting brackets. Provide stainless steel worm gear clamp to fasten bracket to pipe.

2. 0.5-inch (13-mm)-wide fiberglass reinforced pressure-sensitive cloth tape to fasten cable to pipe at 12-inch (305-mm) intervals.
3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 0.5-inch (13-mm) NPT conduit hub, SPST switch rated for 20 amps at system voltage, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature.
4. Signs: Manufacturer's standard meeting NEC requirements, stamped "ELECTRIC TRACED" located on the insulation jacket at 10-foot (3-m) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cables shall be secured to pipes with tape under the insulation in accordance with the manufacturer's recommendations.

B. Provide heat cable on the following locations:

1. Exterior piping:

a. Chilled water.
b. Steam supply and return.

END OF SECTION 15771

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2490 Pa).

B. Related Sections include the following:

1. Division 7 Section Firestopping for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
2. Division 8 Section Access Doors for wall- and ceiling-mounted access doors for access to concealed ducts.
3. Division 10 Section Louvers and Vents for intake and relief louvers and vents connected to ducts and installed in exterior walls.
4. Division 15 Section Duct Insulation for insulation on outside surfaces of ducts.
5. Division 15 Section Duct Accessories for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
6. Division 15 Section Testing, Adjusting, and Balancing for air balancing and final adjusting of manual-volume dampers.

1.2 DEFINITIONS

A. Thermal conductivity and apparent thermal conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1. Example: Apparent thermal conductivity (k-Value): 0.26 or 0.037.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and - distribution equipment and other components of air system. Do not change layout or configuration of duct system except as specifically approved in writing. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 SUBMITTALS

A. Product data: For sealing materials.

B. Shop drawings: Show details of the following:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Coordination duct layout drawings, at scale no less than 0.25-inch to 1 foot, and 0.5-inch to 1 foot for the Seventh-Floor mechanical rooms, indicating pressure classifications and sizes.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint construction.
6. Penetrations through fire-rated and other partitions.
7. Coil and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

C. Welding certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.

D. Field test reports: Indicate and interpret test results for compliance with performance requirements.

E. Record drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.5 QUALITY ASSURANCE

A. Welding standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, Structural Welding Code--Steel, for hangers and supports; AWS D1.2, Structural Welding Code--Aluminum, for aluminum supporting members; and AWS D9.1, Sheet Metal Welding Code, for duct joint and seam welding.

B. Comply with NFPA 90A, Installation of Air Conditioning and Ventilating Systems, unless otherwise indicated.

C. Comply with NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems, unless otherwise indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, sheet steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-steel sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

C. Stainless steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish at humidifier locations.

D. Reinforcement shapes and plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 SEALANT MATERIALS

A. Joint and seam sealants, general: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

1. Joint and seam tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.
2. Tape sealing system: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
3. Joint and seam sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
4. Flanged joint mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

B. Vapor barrier: Polyethylene sheet, 6 mils (0.15 mm) thick, conforming to FS UU-P-147 for permeability.

2.3 HANGERS AND SUPPORTS

A. Building attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.

1. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

B. Hanger materials: Galvanized, sheet steel or round, threaded steel rod.

1. Hangers installed in corrosive atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
2. Straps and rod sizes: Comply with SMACNA's HVAC Duct Construction Standards--Metal and Flexible for sheet steel width and thickness and for steel rod diameters.

C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and riser supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for galvanized-steel ducts: Galvanized steel shapes and plates.
2. Supports for stainless-steel ducts: Stainless-steel support materials.
3. Supports for aluminum ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.4 RECTANGULAR DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's HVAC Duct Construction Standards--Metal and Flexible. Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Construct ductwork to pressure classifications indicated below. Use SMACNA HVAC DCS, Tables 1-5 through 1-13, to determine the required type and design for joint and intermediate duct reinforcements.
2. Where shown and noted on drawings, provide heavier gauge reinforced construction.
3. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
4. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Static-pressure classifications: Unless otherwise indicated, construct ducts to the following:

1. Supply ducts: 4-inch wg.
2. Outside air and return ducts: 3-inch wg (750 Pa), negative pressure.
3. Exhaust and relief air ducts: 2-inch wg (500 Pa), negative pressure.
4. Sheet metal plenums, casings and access doors other than those speciifed in Section 15723, Field Erected Air Handling Units: Construct in accordance with Chapter 6 of SMACNA HVAC DCS.

C. Cross breaking or cross beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Before fabricating ductwork, make field measurements and coordinate layout of ductwork shown on the drawings with the building structure and work of other trades. Resolve conflicts and obtain written approval for deviations before fabrication.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct.

F. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Electrical equipment spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

J. Non-fire-rated partition penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

K. Ductwork shall not penetrate rated partitions where fire or smoke dampers are indicated on the drawings. Connect ductwork only after the damper installation is complete and accepted, as specified in Section, Duct Accessories.

L. Connecting duct to louver: Provide angles or damper collars as required. Slope duct down toward louver. Blank off any part of louver not required to be open, with double pan panels constructed of the same material as the connecting duct, 1.5 inches (38 mm) thick and insulated with 1.5 inches (38 mm) of fiberglass board insulation. Seal connection.

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's HVAC Duct Construction Standards--Metal and Flexible.

B. Pressure classification less than 2-inch wg (500 Pa): Transverse joints.

C. Seal externally insulated ducts before insulation installation.

3.3 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's HVAC Duct Construction Standards--Metal and Flexible.

B. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet (5 m) and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install concrete inserts before placing concrete.

F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.4 CONNECTIONS

A. Connect equipment with flexible connectors according to Division 15 Section Duct Accessories.

B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's HVAC Duct Construction Standards--Metal and Flexible.

3.5 IDENTIFICATION

A. Mark ductwork in accordance with requirements for identification specified in Section 15050, Basic Mechanical Materials and Methods.

3.6 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3.7 ADJUSTING

A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.

B. Refer to Division 15 Section Testing, Adjusting, and Balancing for detailed procedures.

3.8 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Turning vanes.
5. Duct-mounted access doors and panels.
6. Flexible connectors.
7. Duct accessory hardware.

B. Related Sections include the following:

1. Division 8 Section Access Doors for wall- and ceiling-mounted access doors and panels.
2. Division 13 Section Fire Alarm Systems for duct-mounted fire and smoke detectors.

1.2 SUBMITTALS

A. Product data: For the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Fire and smoke dampers.
4. Duct-mounted access doors and panels.

B. Shop drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

1. Special fittings and manual- and automatic-volume-damper installations.
2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

C. Product certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

D. Operation and maintenance data: For dampers to include in operation and maintenance manuals specified in Division 1 section "General Requirements."

1.3 QUALITY ASSURANCE

A. NFPA compliance: Comply with the following NFPA standards:

1. NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Fusible links: One spare link for every four fire dampers installed in the project, with a minimum of two of each type.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, sheet steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-steel sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Extruded aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

D. Reinforcement shapes and plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT DAMPERS, FAN DISCHARGE

A. Description: Counterbalanced for use in fan discharge.

B. Frame: 14-gauge, galvanized, sheet steel, with welded corners and mounting flange.

C. Blades: 16-gauge galvanized steel.

D. Blade seals: Neoprene.

E. Blade axles: Plated steel, 0.5-inch diameter.

F. Tie bars and brackets: Plated steel.

G. Return spring: Adjustable tension.

H. Pivot pins: Stainless steel.

2.3 BACKDRAFT DAMPERS, PRESSURE RELIEF/STATIC PRESSURE CONTROL

A. Description: Counterbalanced.

B. Frame: 0.081-inch-thick extruded aluminum, with mounting flange.

C. Blades: 0.070-inch-thick aluminum sheet.

D. Blade seals: Vinyl, mechanically locked into blade edge.

E. Blade axles: Nonferrous.

F. Tie bars and brackets: Aluminum.

G. Return spring: Adjustable tension.

H. Pivot pins: Stainless steel.

2.4 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure classifications of 3-inch wg (750 Pa) or higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Low-leakage volume dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.

1. Steel frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
2. Roll-formed steel blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
3. Blade seals: Neoprene.
4. Blade axles: Nonferrous.
5. Blade axles: Galvanized steel.
6. Tie bars and brackets: Galvanized steel.

C. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and number of mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

D. Damper hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

A. General: Labeled to UL 555 for use in dynamic systems.

B. Fire rating: One and one-half and three hours.

C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

D. Mounting sleeve: Factory- or field-installed galvanized, sheet steel.

1. Minimum thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

E. Mounting orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized steel blade connectors.

G. Horizontal dampers: Include a blade lock and stainless-steel negator closure spring.

H. Fusible link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

2.6 SMOKE DAMPERS

A. General: Labeled to UL 555S for use in dynamic systems. Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555.

B. Fusible link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

C. Frame and blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.

D. Mounting sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; length to suit wall or floor application.

2.7 TURNING VANES

A. Fabricate to comply with SMACNA's HVAC Duct Construction Standards--Metal and Flexible.

2.8 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class.

B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.9 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard metal-edged connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

C. Extra-wide metal-edged connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

D. Transverse metal-edged connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

E. Conventional, indoor system flexible connector fabric: Glass fabric double coated with polychloroprene.

1. Minimum weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

F. Conventional, outdoor system flexible connector fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.

G. High-temperature system flexible connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz./sq. yd. (542 g/sq. m) and tensile strength of 285 lbf/inch (50 N/mm) in the warp, and 185 lbf/inch (32 N/mm) in the filling.

H. High-corrosive-environment system flexible connectors: Glass fabric coated with a chemical-resistant coating.

1. Minimum weight: 14 oz./sq. yd. (474 g/sq. m).
2. Tensile strength: 450 lbf/inch (79 N/mm) in the warp, and 340 lbf/inch (60 N/mm) in the filling.

2.10 ACCESSORY HARDWARE

A. Instrument test holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter damper accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible duct clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's HVAC Duct Construction Standards--Metal and Flexible for metal ducts.

B. Provide test holes at fan inlet and outlet and elsewhere as indicated.

C. Install fire and smoke dampers according to manufacturer's testing and labeling authority-approved written instructions.

1. Install fusible links in fire dampers.

D. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section Testing, Adjusting, and Balancing.

END OF SECTION 15820

SECTION 15830 - FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Centrifugal and tubular centrifugal fans.

B. Accessories.

1.2 RELATED SECTIONS

A. Curbs: Section 15061.

B. Vibration control supports: Section 15070.

C. Variable-speed motor controllers: Section 16266.

D. Motors: Section 15053.

E. Controls: Sections 15901 through 15903.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop drawings detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

C. Product data: Include rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated. Include static pressure, brake horsepower, and static efficiency plotted against air volume.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics, and motor and electrical accessories.
4. Material gauges and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

D. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed and field-installed wiring.

E. Maintenance data as required in Division 1 and Section 15010.

F. Submit product data which verifies compliance with ASHRAE 90.1, or provide certified performance ratings by a qualified independent testing agency.

1.4 QUALITY ASSURANCE

A. Fans shall be tested and rated in accordance with the applicable AMCA Standard Test Code and Certified Rating Program and bear AMCA Certified Air Rating Seal.

B. Fan selections shall be made to the right of the peak static pressure point, but not on any "flat" portion of the fan curve. Generally, fan selection shall be in the 50 percent to 80 percent range of wide open volume.

C. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

D. Testing and labeling: Where available, provide components tested and labeled by an independent, nationally recognized testing and labeling authority.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units as required for movement to the final location following manufacturer's written instructions.

C. Lift and support units with the manufacturer's designated lifting or supporting points.

1.6 PROJECT CONDITIONS

A. Field measurements: Verify dimensions by field measurements. Verify clearances.

B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

1.7 COORDINATION

A. Coordinate the size and location of concrete housekeeping pads. Cast anchor-bolt inserts into pad. Concrete reinforcement and formwork requirements are specified in Division 3 Sections.

B. Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

1.8 REDUNDANT MATERIALS

A. Provide adjustments in drives and sheaves and belts as required at time of system balancing to obtain the airflow and static pressure indicated on drawings.

B. Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.1 FANS, GENERAL

A. Fan size, capacity, class, arrangement, accessories and discharge shall be as scheduled on the drawings.

B. Motors shall meet the requirements of Section 15053, Motors. Motors shall be suitable for use with variable frequency drive controllers.

C. Belt drives shall be provided with four-sided guards meeting OSHA and MOSHA requirements.

D. Fans shall have self-aligning, ball type bearings designed for thrust load and grease fittings shall be accessible for re-lubrication. Fans shall be statically and dynamically balanced.

E. Motors for belt-driven units shall have adjustable variable pitched cast iron sheaves to allow a 10 percent increase or reduction in speed. Belts shall be sized for minimum 150 percent brake horsepower (bhp).

F. Provide fans with vibration control devices as specified in Section 15070, Vibration Control Supports.

G. Floor-mounted fans shall be provided with concrete inertia bases as specified in Section 15070, Vibration Control Supports.

2.2 CENTRIFUGAL FANS AND TUBULAR CENTRIFUGAL FANS

A. Fans shall be provided with inlet cones.

B. Static and dynamic balancing shall be performed on complete fan wheel assemblies. Necessary weights, if required, shall be welded in place. After final fan assembly, fans shall be operated and again checked for balance, and corrections shall be made if necessary. Vibration amplitude shall not exceed 1.5 mils, peak to peak at the specific operating speed of the fan.

C. Fan housing: Steel, with seams continuously welded, with angle or channel side support members and motor access plates. Discharge outlet shall conform to AMCA recommended standards. Inlet shall have spun cones to provide streamlined airflow into fan wheel. Fan shall have hinged access door in scroll.

D. Bearings shall be heavy duty, self-aligning, ball type with a design average life of 200,000 hours or more based on the optimum speed range of the fan's AMCA class and furnished with grease fittings, extended to be accessible from outside of ducts. Bearings shall be rigidly supported on structural supports connected to the structural base member of the fan. Fan shafts shall be of solid cold-drawn or forged steel, turned, ground, polished and

machined to close tolerance, and keyed to fan wheel. Return air fans shall be Class II minimum assemblies. Supply air fans shall be Class III minimum assemblies.

E. Motor, unless scheduled otherwise, shall be 1750 maximum rpm and suitable for voltage noted on drawings. Two-speed motor, where scheduled, shall be dual winding type. Motors shall have adjustable bases.

F. Drive: Sized for no less than 150 percent of bhp. Drive 25 hp and below shall be variable pitch type, allowing 10 percent increase or decrease in fan speed.

G. Fans mounted without duct connections shall be provided with inlet screens.

H. Base-mounted centrifugal fans and motors shall be mounted on a common structural steel base and inertia base as indicated on the drawings.

I. Complete fan assemblies shall have two coats of enamel paint.

J. Base-mounted centrifugal fans 24-inch wheel diameter and larger shall have horizontal split housings.

K. Tubular centrifugal fans shall comply with the above requirements for centrifugal fans, except fan casing shall be of rolled steel, and fully welded, 12 gauge minimum for wheel diameters through 27 inches, 10 gauge minimum for larger sizes, with straightening vanes and inner shaft and bearing enclosure with integral belt tube. Casings shall have flanged inlets and outlets. Fans shall be furnished with mounting legs, or brackets for ceiling suspension, hinged scroll access door (raised type for insulated fans) for access to wheel, and companion flanges for attachment of flexible connections.

2.3 ACCESSORIES

A. Bird screens: Specified in Section 15820, Duct Accessories.

B. Each fan shall be identified with a fan number no less than 0.5 inch high, as shown in the fan schedule, on an aluminum strip riveted to hood of roof fans and on the motor side of frame for wall fans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the fans. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install fans according to manufacturer's written instructions.

B. Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 15 Section Vibration Control.

C. Install units with clearances for service and maintenance.

D. Coordinate size of housekeeping and inertia bases with actual unit sizes provided. Construct base 4 inches (100 mm) larger, in both directions, than the overall dimensions of the supported unit.

E. Coordinate with air balancing to provide adjustments, sheaves, and belts as required in Part 1 above to obtain the airflow and static pressure indicated on the drawings.

3.3 CENTRIFUGAL FANS

A. Assemble and set the fan in place using spring vibration control supports specified in Section 15070. Where floor-mounted, set on concrete housekeeping pads or inertia bases as indicated on the drawings. Suspended equipment shall have hanger rods and additional structural members for support from beams above.

B. Connect duct to fans with flexible connections.

C. Provide duct access door in inlet and outlet ductwork.

3.4 ACCESSORIES

A. Fans without supply duct on fan inlet shall be provided with bird screens.

3.5 CONNECTIONS

A. Duct installation and connection requirements are specified in Division 15 Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Electrical: Conform to applicable requirements in Division 16 Sections.

C. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's field service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, alignment of fan shaft and motor shaft, alignment of pulleys, belt adjustments, and lubrication, and to report results in writing.

3.7 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.8 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.9 COMMISSIONING

A. Final checks before startup: Perform the following operations and checks before startup:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.

B. Starting procedures for fans are as follows:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
2. Measure and record motor voltage and amperage.

C. Refer to Division 15 Section Testing, Adjusting, and Balancing for procedures for air-handling-system testing, adjusting, and balancing.

D. Replace fan and motor pulleys as required to achieve design conditions.

3.10 OPERATING INSTRUCTIONS

A. As specified in Section 15050, provide operating instructions.

B. Train Government maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

C. Review data in the operation and maintenance manuals. Refer to Division 1 Section Contract Closeout.

D. Schedule training with Architect, with at least 7 days' advance notice.

E. Demonstrate operation of fans. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each fan.

END OF SECTION 15830

SECTION 15861 - FILTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide three sets of filters for every item of equipment requiring filters, as follows:

1. Filters for temporary service during construction.
2. Filters for regular service, installed before air balancing.
3. Filters for regular service, provided as redundant materials.

1.2 RELATED SECTIONS

A. Air handling units: Sections 15722 and 15723.

1.3 DEFINITIONS

A. Temporary service: Operation of equipment during the construction period, before air balancing.

B. Regular service: Operation of equipment during air balancing and in normal use during occupancy.

1.4 SUBMITTALS

A. General: Comply with "Submittals" in Section 01000.

B. Product data: Each type of filter; each holding frame and housing; and each device.

1. For filters, include filter efficiency.
2. For holding frame and housing, include manufacturer's installation instructions.

C. Shop drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchorages.

D. Closeout submittals: As required for Operating and Maintenance Manuals in Division 1, provide a schedule of locations of filters, identifying equipment and filter types and sizes, including prefilters and final filters.

1.5 QUALITY ASSURANCE

A. Provide all filters for regular service from a single manufacturer.

B. Test filters by methods described in Test Standard for Air Cleaner Devices, ASHRAE Standard 52.

C. Comply with NFPA 90A and 90B.

1.6 REDUNDANT MATERIALS

A. Disposable filters: For each filter included in the work, provide one extra filter. Identify each filter with its name and intended location and use.

B. Provide filters and media in protective packaging, with identifying labels or markings.

C. Except as otherwise required in Division 1, deliver to location designated by Owner, and shelve or stack as directed.

PART 2 - PRODUCTS

2.1 FILTERS, GENERAL

A. Coordinate with approved manufacturers of the various approved air handling units and equipment for filter size and thickness required.

B. Filter face areas: As scheduled, or equivalent to one square foot for each 300 cfm.

2.2 DISPOSABLE MEDIUM-EFFICIENCY FILTERS (PREFILTERS)

A. Thickness 2 inches, and size required for each location, disposable.

B. Rating in accordance with ASHRAE Standard 52:

1. Average efficiency: 25 to 30 percent.
2. Average arrestance: 90 to 92 percent.

C. UL Rating: Class 2.

D. Medium: Non-woven, reinforced cotton and synthetic fabric, minimum thickness 0.15 inch, weight 2.5 ounces per square yard, pleated.

E. Medium support grid: Welded wire with an effective open area not less than 96 per cent, bonded to medium.

1. Performance: Medium shall not oscillate nor pull away from support grid.
2. Design: Tapered radial pleats, supporting medium both vertically and horizontally.

F. Enclosing frame: High wet-strength beverage board, with diagonal supports bonded to media pleats. Filter pack continuously bonded to inside of frame so that no air leaks around edges.

2.3 DISPOSABLE CARTRIDGE FILTERS, 90-95 PERCENT

A. High-performance, deep pleated, rigid, and disposable, 12 inches deep.

B. Rating in accordance with ASHRAE Standard 52:

1. Average efficiency: 90 to 95 per cent.
2. Average arrestance: No less than 99 per cent.

C. UL Rating: Class 2.

D. Medium: Microfine glass fibers, laminated to a non-woven synthetic backing to form a lofted blanket.

E. Medium support grid: Welded wire with an effective open area not less than 96 per cent, bonded to medium.

1. Performance: Medium shall not oscillate nor pull away from support grid.
2. Design: Tapered radial pleats, supporting medium both vertically and horizontally.

F. Contour Stabilizers: Permanently installed on both sides of pack.

1. Maintain pleat configuration during life of filter.
2. Withstands 10 inches w.g. pressure drop without evident distortion of the pack.

G. Enclosing frame: Rigid construction of galvanized steel, with diagonal supports on both sides. Filter pack continuously bonded to inside of frame so that no air leaks around edges.

2.4 FILTER HOLDING FRAME

A. 16 gauge stainless steel, equipped with gaskets and four spring type positive sealing fasteners.

B. Fasteners: Capable of being attached or removed without the use of tools.

2.5 FILTER GAUGE

A. Description: Diaphragm type with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

1. Diameter: 4-1/2 inches (115 mm).
2. Range: 0- to 3.0-inch wg (0 to 750 Pa).

B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Before start-up of each item of equipment requiring a filter, install filters for temporary service.

B. Immediately prior to air balancing, remove temporary filters and install filters required for regular service.

3.2 INSTALLING FRAMES

A. Where applicable, install in conformance with SMACNA HVAC Duct Construction Standards.

B. Position units with clearance for normal service and maintenance.

C. Attach securely, following manufacturer's installation instructions.

3.3 INSTALLING FILTER GAUGE

A. Mount across filter section in accordance with manufacturer's instructions.

B. Mount in an accessible position.

END OF SECTION 15861

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.

2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

C. Test, adjust, and balance interior VAV air-handling units (AHUs SZ 1,2; SZ 3,4; SZ 5,6; SZ 7,8): Balance the mains only.

D. Test, adjust, and balance exterior constant-volume air-handling units (AHUs Z-1 through Z-8). Air balance branch mains to airflow noted on the drawings.

E. Test, adjust, and balance temporary air-handling unit on the roof. See air balance setpoints on the drawings. Balance the mains only.

F. Balance miscellaneous fans.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Agent: See "Testing, Adjusting, and Balancing Agent."

C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

D. Certifying agency: Either AABC or NEBB. See "Quality Assurance."

E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. Report forms: Test data sheets for recording test data in logical order.

H. Static head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

I. Suction head: The height of fluid surface above the centerline of the pump on the suction side.

J. System effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

K. System effect factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

L. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

M. Test: A procedure to determine quantitative performance of a system or equipment.

N. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

O. AABC: Associated Air Balance Council.

P. AMCA: Air Movement and Control Association.

Q. NEBB: National Environmental Balancing Bureau.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Quality-assurance submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract documents examination report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and procedures plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified testing, adjusting, and balancing reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample report forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.4 QUALITY ASSURANCE

A. Agent qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

B. Testing, adjusting, and balancing conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

C. Agenda items: Include at least the following:

1. Submittal distribution requirements.
2. Contract Documents examination report.
3. Testing, adjusting, and balancing plan.
4. Work schedule and Project site access requirements.
5. Coordination and cooperation of trades and subcontractors.
6. Coordination of documentation and communication flow.

D. Certification of testing, adjusting, and balancing reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

E. Testing, adjusting, and balancing reports: Use testing, adjusting, and balancing Agent's standard forms approved by the Architect.

F. Instrumentation type, quantity, and accuracy: As described in AABC national standards, or in NEBB's Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, Section II, Required Instrumentation for NEBB Certification.

G. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Full owner occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. General warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special guarantee: Provide a guarantee on certifying agency forms stating that certifying agency will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

C. The certified Agent has tested and balanced systems according to the Contract Documents.

D. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division 1 Section Project Record Documents.

D. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, Fans and Systems, Sections 7 through 10; or in SMACNA's HVAC Systems--Duct Design, Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine strainers for clean screens and proper perforations.

L. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine equipment for installation and for properly operating safety interlocks and controls.

O. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in air handling units.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Sensors are located to sense only the intended conditions.
6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
8. Interlocked systems are operating.

P. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures required for variable-air-volume are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as
   d. possible, upstream from flexible connection and downstream from duct restrictions.
   e. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   f. Fan total static pressure indicated on the drawings includes an additional 1.5 inch w.c. pressure drop for dirty filters.

2. Measure static pressure across each air-handling unit component.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters. An additional 1.5 inch w.c. pressure drop has been included in the fan total static pressure for dirty filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.

   a. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
   b. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
   c. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
   d. Fans with variable frequency controllers shall be set to maintain the fan cfm with clean filters. The controller shall adjust through the discharge, static pressure controller to accommodate filter loading.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

3.6 VARIABLE-AIR-VOLUME SYSTEMS

A. As work of this project, balance VAV air-handling units SZ 1, 2; SZ-3, 4; SZ-5,6 and SZ-7,8 for total airflow, following the procedures described for constant-volume air systems.

3.7 MOTORS

A. Motors, ½ HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors driven by variable-frequency controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.10 HEAT-TRANSFER COILS

A. Water coils: Measure the following data for each coil:

1. Entering- and leaving-water temperatures.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperatures of entering and leaving air.
5. Wet-bulb temperatures of entering and leaving air for cooling coils designed for less than 7500 cfm (3540 L/s).
6. Airflow.
7. Air pressure drop.

3.11 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.12 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of interlock and lockout systems.

H. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

I. Note operation of electric actuators using spring return for proper fail-safe operations.

3.13 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, return, and exhaust fans: Plus 5 to plus 10 percent.
2. Heating-water flow rate: 0 to minus 10 percent.
3. Cooling-water flow rate: 0 to minus 5 percent.

3.14 REPORTING

A. Initial construction-phase report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

C. Provide a balance report for each air-handling unit at the completion of each phase of work when the unit has been tested, commissioned, and turned over to the Government.

3.15 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final report contents: In addition to the certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General report data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of Testing, Adjusting, and Balancing Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of Testing, Adjusting, and Balancing Agent who certifies the report.
10. Summary of contents, including the following:

    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.

13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings, including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

E. System diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Balancing stations.

F. Air-handling unit test reports: For air-handling units with coils, include the following:

1. Unit data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.
    i. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor data: Include the following:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches (mm), and bore.
    f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

3. Test data: Include design and actual values for the following:

   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Preheat coil static-pressure differential in inches wg (Pa).
   g. Cooling coil static-pressure differential in inches wg (Pa).
   h. Heating coil static-pressure differential in inches wg (Pa).
   i. Outside airflow in cfm (L/s).
   j. Return airflow in cfm (L/s).
   k. Outside-air damper position.
   l. Return-air damper position.

G. Apparatus-coil test reports: For apparatus coils, include the following:

1. Coil data: Include the following:

   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch (mm o.c.).
   f. Make and model number.
   g. Face area in sq. ft. (sq. m).
   h. Tube size in NPS (DN).
   i. Tube and fin materials.
   j. Circuiting arrangement.

2. Test data: Include design and actual values for the following:

   a. Airflow rate in cfm (L/s).
   b. Average face velocity in fpm (m/s).
   c. Air pressure drop in inches wg (Pa).
   d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
   e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
   f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
   g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
   h. Water flow rate in gpm (L/s).
   i. Water pressure differential in feet of head or psig (kPa).
   j. Entering-water temperature in deg F (deg C).
   k. Leaving-water temperature in deg F (deg C).
   l. Inlet steam pressure in psig (kPa).

H. Fan test reports: For supply, return, and exhaust fans, include the following:

1. Fan data: Include the following:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

2. Motor data: Include the following:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
g. Number of belts, make, and size.

3. Test data: Include design and actual values for the following:

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Duct traverse reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report data: Include the following:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. ((sq. m)).
g. Design airflow rate in cfm (L/s).
h. Design velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

J. Instrument calibration reports: For instrument calibration, include the following:

1. Report data: Include the following:

   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one Section of Division 16.

B. Electrical identification.

C. Testing wiring systems.

1.2 RELATED SECTIONS

A. Cutting and patching: Section 01731.

B. Operation and maintenance manuals: Section 01000.

C. Painting: Division 9.

1.3 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products scheduled on the drawings.

B. Products of other manufacturers are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the Contract Sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access or connection problems.

D. The contract drawings are generally diagrammatic, and do not indicate all fittings or offsets in conduit or all pull boxes, access panels, or other specialties required.

1. Install conduit exposed to view parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.
2. Install conduit a sufficient distance from other work to permit a clearance of not less than 0.5 inch between its finished covering and adjacent work.
3. No conduit shall be run below the head of a window or door.
4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.4 SUBMITTALS

A. General: Comply with Section 01000.

B. Nameplates engraving list: List of equipment to be identified with engraved nameplates.

C. Coordination drawings: For each item of equipment for which lockout/tagout procedures are required for service, submit a coordination drawing showing how maintenance personnel will have access for the procedures. Coordination drawing for each item of equipment shall be approved before installation of that item of equipment begins.

D. Test reports: Showing that tests specified in Part 3 below demonstrate the specified results.

1.5 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the national electrical, building, fire and safety codes and regulations.

B. Electrical control panels, equipment, materials and devices provided or installed as work of Division 16 shall be tested and labeled by an independent, nationally recognized testing and labeling authority, and in accordance with NEC. Provide testing, if required, without addition to the contract sum.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plywood: PS-1, fire retardant treated, grade B-D with exterior glue and one finished side.

B. Nameplates: Laminated plastic, engraved, white letters on black background, except where other colors are noted or specified.

1. Size: Minimum 0.75 inch (19 mm) by 2.5 inches (64 mm).
2. Letter size: Minimum height 0.1875 inch (5 mm).
3. Fasteners: Stainless-steel screws.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items unless otherwise noted on the drawings.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations, and easy access for Architect's lockout/tagout procedures. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

1. For each item of equipment for which lockout/tagout procedures are required for service, do not begin installation until coordination drawings for installation have been approved, as required in "Submittals" in Part 1 above.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 IDENTIFICATION

A. Items to be identified include, but are not limited to:

1. Existing switchboards circuit breakers for new panelboards.
2. Motor starters.
3. Panelboards.
4. Disconnects.
5. Other appurtenances including receptacles other than 120 volt.

B. Identify function, equipment served, and circuit from which equipment is fed.

3.3 INSTALLING EQUIPMENT FOUNDATIONS (HOUSEKEEPING PADS)

A. Determine exact location of equipment, foundations and supports after Shop Drawings of equipment have been approved.

B. Provide 4-inch-high concrete foundations (housekeeping pads) for floor-mounted equipment unless otherwise noted. Furnish foundations, bolts, sleeves, and appurtenances and set under the section furnishing the equipment. Anchor the concrete foundations by dowels inserted into the floor slab. Provide welded wire fabric reinforcement.

C. Provide concrete work in accordance with the requirements of Division 3.

D. Equipment shall be properly aligned. Level and grout equipment where necessary. Support conduit independently of equipment and so as not to cause a strain or thrust.

3.4 TESTS

A. During the progress of the work and after completion, test the branch circuits and distribution system, and the low voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Lighting, power and control circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable. Demonstration shall include functioning of each control not less than ten times, and continuous operation of each lighting and power circuit for not less than 0.5 hour.

E. Immediately repair defects and re-test until systems are operating correctly.

F. Submit test reports.

3.5 OPERATING INSTRUCTIONS

A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project for two 8-hour days.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Government's designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Government personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Architect.

END OF SECTION 16050

SECTION 16055 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition as indicated on the drawings.

1.2 RELATED SECTIONS

A. Demolition: Division 2.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop Drawings: Demolition and removal procedures and schedules.

1.4 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible in accordance with accepted practice and applicable building code provisions.

1.5 PROJECT CONDITIONS

A. If, in the course of the work, workers unexpectedly encounter a material not identified for special removal but which they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:

1. Promptly notify the Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Assure weather-tightness at all times. Keep materials on hand to patch and maintain protection.

3.2 DEMOLITION

A. Comply with demolition and disposal requirements of Division 2.

B. Perform removal work neatly with the least possible disturbance to the building.

C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.

D. Demolish, remove, demount, and disconnect inactive and obsolete conduit, fittings and specialties, equipment, and fixtures.

1. Conduit and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations.
2. Remove materials above accessible ceilings.
3. Disconnect and cap items to remain behind finish surfaces.
4. Patch and repair surface materials as required in Division 1 Section, Cutting and Patching.

E. Remove anchors, bolts and fasteners, associated with conduit and equipment to be removed.

3.4 DISPOSAL

A. Dispose or recycle equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

END OF SECTION 16055

SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wire, cable, and associated connectors, splices, and terminations for wiring systems rated 600 kV and less.

1.2 RELATED SECTIONS

A. Conduits: Section 16131.

1.3 REFERENCES

A. ASTM B 3: Soft or Annealed Copper Wire.

B. ASTM B 8: Concentric-lay-stranded Copper Conductors, Hard, Medium-hard, or Soft.

C. NEMA WC 3: Rubber-insulated Wire and Cable for the Termination and Distribution of Electrical Energy.

D. NEMA WC 5: Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

E. NEMA WC 70: Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

1.4 SUBMITTALS

A. General: Comply with Section 01300.

B. Product data: Each type of wire and cable, including accessories.

C. Field quality-control reports: Tests specified in Part 3 below.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE CONDUCTORS (600 V. MAX.)

A. Conductors: Copper, 98 percent conductivity, suitable for 600 volt duty, Type THWN polyethylene-insulated, rated 90 degrees C (dry) and 75 degrees C (wet), solid for No. 10 and smaller and stranded for No. 8 and larger and when specifically noted.

1. Exception: For temporary wiring associated with the temporary rooftop unit, aluminum conductors of equivalent ampacity may be substituted for the copper conductors indicated on the drawings. Contractor shall adjust conduit sizes

appropriately when exercising this option. Aluminum and copper conductors shall comply with NEMA WC70.

B. Conductors identification: Markings along their outer braid denoting conductor size, type of insulation, and manufacturer's trade name, and color code. Identification shall extend to branch circuits and outlets. Use the color coding system tabulated below throughout the building's network of feeders and circuits, and as a basis for balancing the load. Use color coding for wiring as follows but clearly tagged in all outlets, fixtures, and as appropriate.

1. Colors on Conductors No. 10 and Smaller: Solid colored insulation.
2. Colors on Conductors No. 8 and Larger: Colored tape wrapped a minimum of 6 inches on either end of conductor.

COLOR CODE				
	NEUTRAL	PHASE A	B	C
120-V, 2 wire	White	Black, Red or Blue depending on phase		
208Y-120-V, 3-phase, 4-wire	White	Black	Red	Blue
480/277-V, 3-phase, 4-wire	Gray	Brown	Orange	Yellow
480-V delta, 3-phase, 3-wire	--	Brown	Orange	Yellow

C. Wires used solely for grounding purposes shall be green, if insulated. Control wiring shall be color-coded with colors different from those used to designate phase wires.

D. Multiconductor Cable: Comply with NEMA WC 80 for metal-clad cable, type MC.

2.2 CONNECTORS AND SPLICES

A. Factory-fabricated wiring connections of size, ampacity rating, material, type, and class for the application and service indicated, tested and labeled by an independent, nationally recognized testing and labeling authority.

2.3 FIRE ALARM CABLING

A. 14 gage solid, 4-conductor, red fluoropolymer insulated jacket, UL listed FPLP (Plenum), temperature rated 200 degrees C, 300 V.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide wiring indicated in accordance with National, State and Local Electric Codes.

3.2 INSTALLING INTERIOR WIRING

A. Splicing shall be done in outlet boxes and junction boxes and not in conduit. Conductors No. 8 and larger shall be terminated, spliced and taped, wherever practical, with compression connectors or solderless connectors. Use tools recommended by the manufacturer. Splices in conductors No. 10 and smaller, including lighting fixtures, shall be made with wire connectors. Taps occurring in conductors No. 6 and larger shall be made with compression taps.

B. Wiring in fluorescent fixture channels or in other high ambient temperature areas shall be of types required by NEC.

C. Circuit numbers shown on drawings indicate quantity only. Connect loads to panels so that loads are evenly balanced on all phases equally. Wires shall be neatly shaped in panels, troughs, boxes, and appurtenances to the satisfaction of the Engineer.

3.3 INSTALLING CABLE (LINE VOLTAGE-100 VOLTS TO 600 VOLTS)

A. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 INSTALLING CABLE (LOW VOLTAGE - BELOW 100 VOLTS)

A. Cables shall be installed in conduit raceways. The cable routes used should avoid steam lines, water pipes and other utilities which may adversely affect the system's performance or result in damage to the cable. If cable must be placed close to such utilities, keep it separate and protect with insulation. Separate conduit systems shall be used for each low voltage system.

B. During installation, do not deform cable by improper bending, stretching, twisting, kinking, or pinching, nor do any other abusive handling. Replace deformed cable with new during the demonstrations following completion of the installation. Each cable run shall contain an "S" loop or other means to accommodate expansion or contraction as required. Cable bends will have a radius not less than the value recommended by the cable manufacturer. Tag cables connected to electronic equipment, to show function and the location of other end. Labels shall be securely fastened to the cable.

C. Project has ceiling plenums used for passage of air by heating and air conditioning system. Low voltage cables and wiring shall be installed in conduit.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the major equipment installed as work of this project, for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16131 - CONDUITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and accessories, above ground.

1.2 RELATED SECTIONS

A. Firestopping: Section 07840.

B. Boxes: Section 16134.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data:

1. Each type of conduit included in the work, and related fittings.
2. Accessory materials.
3. Hangers and fasteners.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Galvanized steel conduit: Hot-dip galvanized with threads galvanized after cutting, one of the following:

1. Rigid full weight, heavy-wall steel conduit (RGS) conforming to UL 6 and ANSI C 80.1.
2. Intermediate steel conduit (IMC) conforming to UL 1242 and ANSI C 80.6.

B. Steel conduit fittings: Cast malleable iron fittings with smooth finish and full threaded hubs. Include steel or malleable iron locknuts, bushings, and other fittings.

1. Insulating bushings: All plastic.
2. Hub fittings with recessed sealing ring and nylon insulated throat.
3. Fittings for exposed locations: Conduit outlet bodies, zinc- or cadmium-plated.

C. Electrical metallic tubing (EMT): Hot-dip galvanized or sherardized thin-wall steel conduit conforming to UL 797 and ANSI C80.3.

D. Connectors and couplings for EMT: Concrete- or rain-tight, compression or set screw type, made of cadmium plated steel with nylon insulating throat except fire alarm conduit shall use compression fittings.

E. Flexible metal conduit: Made of sheet metal strip, interlocked construction, conforming to UL 1.

F. Liquidtight flexible metal conduit shall conform to UL 360, with liquid-tight connectors.

G. Connectors for flexible metal conduit: Angle wedge type with nylon insulated throat.

H. Wiring troughs: Steel wiring trough (wireway) with hinged cover.

1. Cover: Opening complete width and length of trough;
2. Finish: Baked enamel.

I. Fittings for wiring troughs: Made with removable covers and sides to permit installation of a complete system with access to wires throughout the system.

J. Weatherproof expansion fittings with bonding jumpers.

2.2 ACCESSORY MATERIALS

A. Pull rope: Polypropylene, minimum 0.1875 inch (5 mm) thick, tensile strength 800 lbs (3559 N), work load 130 lbs (578 N).

B. Lubricant: Tested and approved for use in wiring system approved.

2.3 SUPPORTING DEVICES

A. Metal items, outdoors or indoors: Hot-dip galvanized steel.

B. Slotted-steel channel supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

1. Channel thickness: Selected to suit structural loading.
2. Fittings and accessories: Products of the same manufacturer as channel supports.

C. Raceway and cable supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

D. Pipe sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

E. Cable supports for vertical conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

F. Expansion anchors: Carbon-steel wedge or sleeve type.

G. Toggle bolts: All-steel springhead type.

H. Powder-driven threaded studs: Heat-treated steel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide complete, separate and independent raceway system for each of the various wiring systems including, but not limited to, the following:

Lighting
Power
Fire alarm system

B. Wire all power raceway systems completely, as shown on drawings and as required for satisfactory operation of each system.

C. Raceways, generally, shall be concealed conduit of types and sizes shown and specified. Where wiring troughs are required or used to facilitate the installation, amply size them to accommodate conductors, in accordance with the NFPA 70.

D. Types and locations of conduits are scheduled at the end of the section.

E. Where conduit penetrates floors or fire-rated construction, penetrations shall be firestopped as specified in Section 07840, Firestopping.

F. Do not install conductors or pull rope during installation of conduit.

G. Where conduit is connected to a cabinet, junction box, pull box or auxiliary gutter, protect the conductors with an insulating bushing. Provide locknuts both inside and outside the enclosure. Where conduit is stubbed up to above ceilings for future wiring, close ends with bushings.

H. Turns in conduit runs shall be accomplished by use of manufactured elbows or by use of machines or tools designed to bend conduit. Turns shall be not less than the various radii permitted by NFPA 70.

I. Sizes:

1. Do not use conduit smaller than 0.75 inch (21 mm), except where otherwise indicated.
2. Feeder conduits shall be as large as indicated, or as required by NEC. Do not install more than one feeder in a single conduit.
3. Conduit sizes shown on drawings are based on Type THWN wire.

J. Run conduits in exposed locations in a neat and workmanlike manner. Make turns with conduit bodies or junction boxes. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

K. Ground conduits as required by the NEC.

L. Where conduits pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

M. Where conduits through roof cannot be installed inside equipment or pipe curbs, flash them in accordance with the SMACNA Architectural Manual.

N. Run conduits concealed except where connecting to surface mounted cabinets and equipment in electrical and mechanical equipment spaces. Install conduit above suspended ceiling throughout wherever possible, and within walls and partitions.

O. Immediately after each run of conduit is completed, test it for clearance, smooth the joints, and close at each end with caps or plugs to prevent entrance of moisture or debris.

P. Conduit installed outdoors or at indoor locations exposed to continuous or intermittent moisture shall provide a liquidtight seal. Use steel or malleable iron hub fittings. Coat exposed threads with bituminous protective coating.

3.2 INSTALLING PULL BOXES, JUNCTION BOXES, OUTLET BOXES

A. Install as specified in Section 16134, Boxes.

B. Install pull or junction boxes in long runs of conduits or where necessary to reduce the number of bends in a run.

1. Select inconspicuous locations. Do not install until locations have been approved by the Engineer.
2. Install boxes above ceilings.

C. Verify all door swings before locating switch outlets.

3.3 INSTALLING FLEXIBLE CONDUIT

A. Installation shall comply with NFPA 70 Articles 350 and 351.

1. Minimum length: Two feet.
2. Maximum length: Six feet.

B. Make immediate connections to motors and transformers with liquid-tight flexible conduit. Include sufficient slack to reduce the effects of vibration.

C. In wet locations, install liquid-tight type, in such a manner that liquids tend to run off the surface and not drain toward the fittings.

D. Where fittings are brought into an enclosure with a knockout, install a gasket assembly consisting of an "0" ring and retainer on the outside.

3.4 INSTALLING PULL ROPE AND CONDUCTORS

A. After conduit is installed, "fish" pull rope. After completion of the work of this project, pull rope shall remain in conduits identified as to be left "empty."

B. Do not use a pull rope that has a tensile strength of more than one of the conductors of a two wire circuit, more than two of the conductors of a three wire circuit, or more than three of the conductors of a four wire circuit.

C. Do not pull conductors into the conduits until the system is entirely completed.

D. Use only an approved lubricant for pulling wires.

3.5 INSTALLING CONDUIT HANGERS

A. Single runs of overhead conduits 1.25 inch size and larger shall be supported by adjustable hangers, using 0.375-inch (10-mm) rods for conduits up to 2.0 inch (53-mm) size and 0.5-inch (13-mm) rods for conduits larger than 2.0 inches (53 mm).

B. Support groups of conduits run in parallel on trapeze hangers suspended from 0.5-inch (13-mm) hanger rods.

C. Space hangers not over 10 feet (3 m) apart.

D. Below bar joist construction, support hangers from a length of structural channel, welded to the top chords of at least two joists.

E. Where large numbers of conduits are grouped together, stagger individual hangers so as not to concentrate the load on a few joists.

F. Where hanger rods are attached to structural beams, use adjustable beam clamps.

3.6 WORK IN EXISTING BUILDING

A. Remove all superfluous electrical equipment, panels, outlets, conduits, wire, and appurtenances in existing building, and suitably cap all existing flush outlets not being used.

B. In existing areas that are being renovated it is the intent to show on the drawings what the finished areas will contain when completed. Except as specified otherwise, reuse existing conduit, and outlet boxes where they meet specifications and code requirements. Replace existing products or materials which are not suitable for reuse as determined by the Architect.

C. Suitably cap superfluous concealed outlets, and remove unused wire. Remove superfluous raceways exposed in finished areas, and abandon superfluous raceways concealed in walls. Abandoned conduits in and through walls or floors shall be cut flush, filled with concrete, and finished flush with floor or wall.

D. Install wiring in existing building concealed wherever possible above.

3.7 SCHEDULE OF LOCATIONS

A. Rigid steel conduit or intermediate weight conduit (IMC) with screw joint couplings:

1. Conduits 2.0 inch size and larger.
2. Wiring to exterior equipment.
3. Wiring to equipment located in the seventh floor mechanical spaces.

B. EMT (electric metallic tubing):

1. Sizes 1.5 inch and smaller except as noted above.

END OF SECTION 16131

SECTION 16134 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boxes with covers.

1.2 RELATED SECTIONS

A. Conduits: Section 16131.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each type of box included in the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Outlet, switch and junction boxes: Sherardized or galvanized stamped or cast steel, or cast aluminum where required for weather-exposed locations.

2.2 MANUFACTURED UNITS

A. Junction and pull boxes in feeder conduit runs: Galvanized, of size required for conduit arrangement and not less than the size required by NEC, and furnished with screwed covers.

PART 3 - EXECUTION

3.10 INSTALLATION

A. Provide box at each outlet, switch and appurtenance. Each box shall be of a type suitable for the duty intended and shall be installed in accordance with the manufacturer's instructions.

1. Where conduit is exposed, provide cast steel or aluminum boxes.

B. Coordinate locations of boxes with installation of conduit as specified in Section 16131.

C. Firmly secure the boxes in place, plumb, level and with front of device cover even with finished wall surface.

D. Outlet boxes used for supporting lighting fixtures: Furnish with malleable iron fixture studs of "No-Bolt" type, secured by locknut. Provide structural channel supports for boxes

occurring in ceilings. Outlets in ceilings directly on bottom of joists shall be supported independent of ceiling construction.

END OF SECTION 16134

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wiring devices.

B. Smoke detectors.

C. Receptacles.

1.2 RELATED SECTIONS

A. Nameplates: Section 16050.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each type of device used in the project.

PART 2 - PRODUCTS

2.1 SWITCHES AND RECEPTACLES

A. Wiring devices shall be heavy-duty specification grade.

1. Switches: Single-pole and 3-way 20A, 120/277 V.
2. Switch and pilot light, two-gang: Switch as above with pilot light receptacle, neon lamp and red jewel.
3. Duplex convenience receptacles: NEMA 5-20R.

B. Device color: Brown.

C. Device plates: Type 302 stainless steel in finished areas and galvanized steel in unfinished areas.

2.2 SMOKE DETECTORS

A. General: Include the following features:

1. Operating voltage: 24-V dc, nominal.
2. Self-restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.

4. Integral visual-indicating light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral addressable module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric smoke detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Integral thermal detector: Fixed-temperature type with 135 deg F (57 deg C) setting.

C. Duct smoke detector: Photoelectric type.

1. Sampling tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
2. Relay fan shutdown: Contacts rated to interrupt fan motor-control circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

3.2 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Replace damaged or defective components.

3.4 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 15901 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Building Automation System (BAS).
2. Control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Project Software and documentation shall become Government's property, including, but not limited to:

1. Graphics.
2. Record drawings.
3. Database.
4. Application programming code.
5. Documentation.

C. See attachments at end of Section:

1. Specification 15900 Appendix A.
2. Graphics for Typical Pump Monitoring.

D. Products Furnished but Not Installed under this Section

1. Automatic control valves, pressure and flow switches, and insertion wells in piping: For installation under Division 15 Section "Heating and Cooling Piping."
2. Dampers: For installation under Division 15 Section "Duct Accessories."

E. Related Sections include the following:

1. Division 15 Section "Meters and Gages" for measuring equipment that relates to this Section.
2. Division 15 Section "Duct Accessories" for installation requirements for automatic dampers.

1.3 REFERENCED STANDARDS

A. Air Movement and Control Association International, Inc.

1. AMCA 500D: Methods of Testing Dampers for Rating

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers

1. ASHRAE 135: BACnet - A Data Communication Protocal for Building Automation and Control Networks

C. ASME International

1. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

D. ASTM International

1. ASTM A 126: Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
2. ASTM A 536: Specification for Ductile Iron Casting
3. ASTM B 88: Specification for Seamless Copper Water tube
4. ASTM B 88M: Specification for Seamless Copper Water Tube [Metric]
5. ASTM B 280: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. ASTM D 2737: Specification for Polyethylene (PE) Plastic Tubing.

E. Electronic Industries Alliance/Canadian Electricity Association

1. EIA/CEA 709.1: Control Network Protocol Specification

F. The Instrumentation, Systems, and Automation Society (67 Alexander Dr., Research Triangle Park, NC 27709; 919-549-8411)

1. ISA 50.00.01: Compatibility of Analog Signals for Electronic Industrial Process Instruments

G. National Electrical Manufacturers Association

1. NEMA 250: Enclosures for Electrical Equipment (100 Volts Maximum)
2. NEMA DC 3 (Revised 1996): Residential Controls - Electrical Wall-Mounted Room Thermostats.

H. NFPA

1. NFPA 70: National Electrical Code

I. Architect of the Capitol (AoC) Building Automation and Control System Communication Integration Plan for the U.S. Capitol Complex, latest revision (AIP), and BAS Master Plan, latest revision.

1.4 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. BACnet: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

E. BAS: Building automation system.

F. CU: Control Unit.

G. DAC: Direct analog controls.

H. DDC: Direct-digital controls.

I. LAN: Local area network.

J. LANID: LAN interface device.

K. OI: Operator Interface.

L. PCWS: Personal computer workstation.

M. PICS: Protocol Implementation Conformance Statement.

N. POT: Portable Operators Terminal.

O. PID: Proportional plus integral plus derivative.

P. RTD: Resistance temperature detector.

1.5 SYSTEM DESCRIPTION

A. Provide a complete BAS of direct digital temperature controls with electronic or electric actuation.

B. The BAS shall consist of two levels of network communication and wiring, DDC controllers, application-specific controllers, software, operator I/O devices, sensors and other necessary input hardware, dampers, valves, actuators and other necessary output hardware, fire and smoke devices, electrical power surge protection, other necessary equipment and a complete system of wiring to fulfill the intent of the sequences of operation shown on the drawings.

C. BAS consists of totally native BACnet-based distributed logic control system complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software and Microsoft Windows XP Pro operators terminal. System Local Area Network Interface Devices (LANID), Control Units (CU) and input/output devices shall communicate using protocols and Local Area Network (LAN) standards as defined ANSI/ASHRAE Standard 135, BACnet.

D. The BAS system shall communicate through the AoC LAN to campus-wide BASnet system servers. Presently, the servers use Microsoft Server 2003 operating system software, and Automated Logic's WEBCtrl web control application software. All physical and software points detailed in the I/O summary shall be integrated into the existing WEBCTRL Thin-Client Server database, and shall conform to the ASHRAE BACnet standards. Graphics shall be constructed using existing Senate graphic configuration tools and be consistent with the style and colors used by the existing BAS system. Senate graphics takes precedence over other jurisdiction graphics. See Appendix at the end of this section.

1. IP address and DDC I/O shall confirm to AIP requirements and be coordinated with the Architect's BAS Engineer.
2. The operator shall be able to access, command and edit all point and program information in the new DDC controllers from any existing DDC controller, DDC workstation, or operator consoles.
3. Provide a current copy of all DDC Controller Devices software from the owner. The intent is for the Government's trained technical representative to have the ability to completely set up and program each and every device supplied with the system.
4. User levels and priority levels are defined in the AIP.
5. Integrate graphics into existing graphics; for example, use an existing icon for Dirksen SOB AHU shall go to new AHU graphic, and new icon for home shall go to existing Senate home graphic.
6. Provide 100 graphics for operations and maintenance.
7. Provide 10 trend graphics.
8. Provide 2 new alarm graphics and link alarms to existing alarm graphics.
9. Provide occupied/unoccupied schedule graphic(s).
10. Provide icons for O&M Manuals linking to embedded O&M Manuals and drawings in .pdfs.
11. Submit graphics for approval, as specified in "Submittals" below.

1.6 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
2. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

   a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
   b. Water Flow: Plus or minus 5 percent of full scale.

c. Water Pressure: Plus or minus 2 percent of full scale.
d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
g. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
i. Relative Humidity: Plus or minus 2 percent.
j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
l. Airflow (Terminal): Plus or minus 10 percent of full scale.
m. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
n. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
o. Carbon Monoxide: Plus or minus 5 percent of reading.
p. Carbon Dioxide: Plus or minus 50 ppm.
q. Electrical: Plus or minus 5 percent of reading.

1.7 SEQUENCE OF OPERATION

A. Sequence of operation for automatically controlled equipment is shown on drawings. ATC subcontractor shall cooperate with the unit suppliers and provide all relays and wiring required to integrate the sequence of operation.

1.8 SUBMITTALS

A. Contractor qualifications:

1. Only manufacturers that produce building automation systems that meet the requirements of ANSI/ASHRAE BACnet standard 135-2001 for native BACnet systems will be considered. Existing DDC BACnet equipment suppliers serving the Senate Office Buildings include Alerton and Automated Logic Corporation. Other manufacturer's equipment proposed for the project must be approved by the Architect prior to the bid.
2. Submit a list of a minimum of three projects similar to this project in type, size, and duty, which have been operating satisfactorily for not less than five years.

   a. Include project name, address, name and phone number of Owner's representative and project size and type.

B. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit ASHRAE BACnet Performance Implementation Conformance (PIC) statements for each DDC system component (panel, zone controller, field devices, and operator workstation) proposed.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation

equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including flow characteristics.
7. DDC System Hardware:

   a. Wiring diagrams for control units with termination numbers.
   b. Schematic diagrams and floor plans for field sensors and control hardware.
   c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

8. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.

   a. Submit proposed icons and graphics.

9. Controlled Systems:

   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
   c. Written description of sequence of operation including schematic diagram.
   d. Points list.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

E. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.

2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

G. Qualification Data: For Installer and manufacturer.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in "Record Document Submittals" and "Maintenance Manuals" in Section 01000, include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

J. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Qualified subcontractor shall prepare control diagrams.

C. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county, or city in which the work is performed.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASHRAE 135 for DDC system components.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.11 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans.

B. Coordinate equipment with Division 13 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate supply of conditioned electrical branch circuits for control units.

1.12 REDUNDANT MATERIALS

A. Provide a manufacturer's recommended spare parts list.

B. Provide redundant items including, but not limited to those listed below, packaged with protective covering suitable for storage and identified with labels describing contents.

1. Space temperature sensor.
2. Space humidity sensor.
3. Water temperature sensor.
4. Water differential-pressure sensor.
5. Duct temperature sensor.
6. Duct humidity sensor.
7. Air differential-pressure switch.
8. Air differential-pressure sensor.
9. Carbon dioxide sensor.
10. Current relay.
11. Relays of each type.
12. DDC's of each type.
13. DDC power supplies of each type.
14. Quantities: Ten percent of the number of devices installed in the system (round fractions up).

C. Provide special tools to install, calibrate, or maintain every control device required to accomplish the sequences of operations indicated on the drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Only manufacturers that produce BAS that meet the requirements of the ANSI/ASHRAE BACnet Standard 135 for native BACnet systems shall be allowed. The following is a list of vendors, listed in alphabetical order, that are known to manufacture native BACnet BAS.

1. Alerton
2. Andover
3. Automated Logic
4. Delta Controls
5. Reliable Controls
6. Any other manufacturer's proposed equipment must be pre-approved by the Architect before bidding.

2.2 DDC EQUIPMENT

A. Diagnostic Terminal Unit: Provide five portable notebook-style, PC-based microcomputer terminals with Windows XP Pro system, capable of accessing system data by connecting to system network via RS-232 port with minimum configuration as follows:

1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 4 or equivalent by AMD, minimum 2.0 GHZ.
3. Random-Access Memory: 512 MB.
4. Graphics: Video adapter, minimum 1280 x 1024 pixels, 64-MB video memory.
5. Keyboard: QWERTY 105 keys in ergonomic shape.
6. Floppy-Disk Drive: 1.44 MB.
7. Hard-Disk Drive: minimum 40 GB.
8. CD-ROM Read/Write Drive: 48x24x48.
9. Pointing Device: Touch pad or other internal device.

B. Provide all hardware and software application programs required for the project so AoC tenchnicans can program and modify all field-installed DDC panels.

C. Building Controllers (BC): Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:

   a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
   b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
   c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
   d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
   e. Remote communications.
   f. Maintenance management.
   g. Units of Measure: Inch-pound and SI (metric).

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 Compliance: Control units shall use ethernet ASHRAE 135 protocol. Communications shall be Annex J BACnet over ethernet I/P and conform to BACnet building controller (B-BC) device profile, as specified in BACnet Annex L.
6. Each BC shall reside in or be connected to the BACnet network using ISO8802-3 (ethernet) datalink/physical layer protocol and BACnet I/P addressing. Each BC shall be connected to the nearest CISCO hub using CAT-5E quality cables. Coordinate with Architect for hub locations.

D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.3 APPLICATION-SPECIFIC CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.

4. Indoor Enclosures: Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).
5. Outdoor Enclosures: Waterproof rated for operation at 40 to 150 deg F (5 to 65 deg C).
6. Application-specific controllers must conform to device profile specification BACnet Annex L, and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) product listing.

2.4 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required. Provide combination temperature and humidity sensors where indicated on the drawings.

B. Thermistor Temperature Sensors and Transmitters:

1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 12 inches (300 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
4. Averaging Elements in Ducts: Flexible, patterned across duct, length as required to cover full cross-sectional area.
5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensor Cover Construction: Manufacturer's standard locking covers. Provide with a humidity sensor where indicated on the drawings.

    a. Set-Point Adjustment: Concealed.
    b. Set-Point Indication: Concealed.
    c. Thermometer: Concealed.
    d. Orientation: Vertical.

7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Accuracy: Plus or minus 0.5 degrees F (0.3 degrees C) at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 12 inches (300 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
4. Averaging Elements in Ducts: Flexible, patterned across duct, length as required to cover full cross-sectional area.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).

6. Room Sensor Cover Construction: Manufacturer's standard locking covers.

   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Thermometer: Concealed.
   d. Orientation: Vertical.

7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Humidity Sensors: Industrial grade two wire transmitter with bulk polymer sensor element.

1. Accuracy (percent RH): Plus 1 percent at 0-80 percent RH ambient at 68 degrees F±3 percent at 94 percent RH ambient at 77 degrees F, including hysteresis, linearity and repeatability.
2. Sensor Range: 0 to 100 percent relative humidity.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers.

   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Thermometer: Concealed.
   d. Orientation: Vertical.

4. Duct Sensor: 0 to 100 percent relative humidity range with element guard and mounting plate.
5. Outside-Air Sensor: 0 to 100 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 10 to plus 160 deg F.

E. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.

   a. Accuracy: 1 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
   d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).

2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Provide carbon dioxide sensors with integral transducers in return air ducts where noted. Output signal shall be 4 to 20 MA or 0 to 10 Vac. Accuracy shall be five percent of full range.

2.5 STATUS SENSORS

A. Airflow Status Inputs: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Water flow Status Inputs: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current. Provide current switches for constant-speed motors and analog current sensors for motors controlled by variable frequency drives.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

G. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

H. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

2.6 THERMOSTATS

A. Electric, Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

B. Electric, Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

2. Selector Switch: Integral, manual on-off-auto.

C. Electric Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full cross-sectional area of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

D. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

E. Airstream Insertion Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

F. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

2.7 HUMIDISTATS

A. Electric Duct-Mounting High-Limit Humidistats: 2-position type, 20 to 80 percent operating range, and single- or double-pole contacts.

2.8 ACTUATORS

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close off at not less than 1.2 times pump shut-off pressure.
2. Dampers: Size for running torque calculated as follows:

a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.

b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.

c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.

d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.

e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.

f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Two-Position Spring Return): 24-V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F.
10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
11. Run time: 12 seconds open; 5 seconds closed.

2.9 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Hydronic steam globe valves shall have the following characteristics:

1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, single-seated, bronze trim, stainless-steel rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, single-seated, bronze trim, stainless-steel rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.

4. Sizing: 4-psig (28-kPa) maximum pressure drop at design flow rate or the following:

a. Two Position: Line size.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head for three-way valves.

C. Steam system globe valves shall have the following characteristics:

1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, stainless steel rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, stainless steel rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel seats.

   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.

4. Sizing: Maximum pressure drop based on the following services:

   a. Low-pressure systems 15 psi (103 kPa) and under: 5 psi maximum pressure drop.

5. Flow Characteristics: Modified linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of operating (inlet) pressure.

2.10 DAMPERS

A. Dampers: AMCA-rated, opposed-blade design for modulating control and parallel-blade design for 2-position controls; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 72 inches (1830 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
3. Blade Edge Seals, Standard Pressure Applications: Closed-cell neoprene. Dampers requiring 100 percent closure shall have closed-cell neoprene edge seals mechanically locked into blade edge.

4. Edge Seals, Low-Leakage Applications: Outside air, pressure relief and exhaust air dampers shall have closed-cell neoprene blade edge seals. Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 160 cfm per sq. ft. (530 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

B. Smoke Dampers: Low leakage type in accordance with UL Standard 5555, Class 1 with elevated Category B electronic damper operator.

2.11 AIRFLOW MEASUREMENT

A. Electronic measuring devices sensing air flow rate by thermal anemometer using instrument-grade self-heated thermistor sensors which shall measure, report, and record air velocity and temperature.

B. Operation:

1. Unit factory-calibrated.
2. Total installed system accuracy: 3 percent of reading, including sensor and transmitter accuracy and sensor location.
3. Sensing ranges:

a. Temperature: -20 to 160 degrees F (-28.9 to 71.1 degrees C).
b. Humidity (noncondensing): 0 to 99 percent.
c. Velocity: 0 to 5,000 fpm.
d. Pressure drop: Less than 0.005 inch wg at 2,000 fpm.

4. Flow measurement drift during the lifetime of the equipment shall not exceed manufacturer's repeatability statement.

C. Sensors: At each sensing point, instrument-grade, self-heated, glass-encapsulated thermistor sensors for measuring air velocity, and Type 316 stainless-steel, encapsulated temperature sensor.

1. Each sensor shall communicate to the airflow station control panel.

D. Return airflow station: Designed for mounting in ducts, number of sensing points recommended by manufacturer for the specified 3 percent accuracy in each location, with tubular aluminum struts and aluminum enclosure, with control panel.

E. Outdoor airflow station: Factory-fabricated, calibrated unit consisting of aluminum assembly sheave, sensors, and aluminum support struts, designed to maintain 3 percent system accuracy, damper, damper actuator, plenum-rated connecting cable, and aluminum control panel for remote mounting.

1. Damper blades: Low-leakage, airfoil type, aluminum, with extruded EPDM blade seals.

2. AMCA-certified air leakage shall not exceed 10.3 cfm/sq ft through a 48 by 48-inch damper at 4 inches wg.
3. Pressure drop shall not exceed 0.02 inches wg at 1,000 fpm.
4. Celcon inner bearing fixed to a 7/16-inch hex blade axle within a polycarbonate outer bearing in the frame, with no metal-to-metal or metal-to-plastic contact.
5. Linkage: In the frame side, aluminum and zinc- or nickel-plated steel.
6. Sleeve: Extruded aluminum, 16 inches, with 1-inch flange.
7. Maximum total length including damper: 20 inches.
8. Actuator: Electronic, 0-10 Vdc, tristate, spring return powered from 24 Vac.

F. Supply airflow station: Located in inlets of supply fans, consisting of inlet casing, sensors, and support struts, designed to maintain 3 percent total system accuracy.

1. Inlet casing shall be sized for the actual supply fan submitted and approved for the project.
2. Temperature and velocity sensors: Housed in nylon with adjustable steel support struts with nylon mounting feet.
3. Plenum-rated connecting cable shall connect sensor strut to aluminum control panel.

G. Airflow straightener: Framed, 1.5-inch-thick aluminum honeycomb, 3/8-inch cells, less than 0.02 inch wg air pressure drop at 1,000 fpm, effect equal to adding 4 diameters of straight duct.

H. System process center: Microprocessor-based panel shall receive signals from the sensors and transmit individual analog signals to the building automatic temperature control system (BAS - Building Automation System).

1. Enclosure: NEMA 250 Type 1 with RFI shielding.
2. Transmitter range: 0 to 0.5 inches wg with 1 percent accuracy of full span.
3. Capacity: Up to 12 analog outputs with a 0-5 or 0-10 Vdc or 4-20 mA signal for each; and logging ability up to 4096 events.
4. Display: Backlighted, 4 lines, 80 characters, alphanumeric.
5. Programming: Uploaded or downloaded via an RS 232 port:

   a. Selectable scale.
   b. Location names.
   c. Multipoint recalibration.
   d. Adjustable digital output filter.
   e. Diagnostics.

6. Operating range: 45-120 degrees F (7.2-48.9 degrees C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to Building Controllers, local DDC panels and control units.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermistor, temperature sensors, humidity sensors, and carbon dioxide sensors, and other exposed control sensors with Drawings before installation.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install automatic dampers according to Division 15 Section "Duct Accessories".

E. Where possible, install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

F. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."

G. Install piping instrument wells, valves, and other accessories according to Division 15 Section "Heating and Cooling Piping."

H. Install electronic and fiber-optic cables according to BICSI TCI, TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, and TIA/EIA-569-A.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."

B. Install building wire and cable according to Division 16 Section "Conductors and Cables."

C. Connect manual-reset limit controls independent of manual-control switch positions.

D. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

E. Install signal and communication cable:

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables following a common path.

5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Pressure test high-pressure control air piping at 150 psig (1034 kPa) and low-pressure control air piping at 30 psig (207 kPa) for 2 hours, with maximum 1-psig (7-kPa) loss.
5. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
6. Test each point through its full operating range to verify that safety and operating control set points are as required.
7. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
8. Test each system for compliance with sequence of operation.
9. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check dampers. Verify that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:

a. Verify that DDC controller power supply is from emergency power supply, if applicable.
b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

a. Check analog inputs at 0, 50, and 100 percent of span.
b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
c. Check digital inputs using jumper wire.
d. Check digital outputs using ohmmeter to test for contact making or breaking.
e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 1 Section "General Requirements" and training requirements indicated below.

B. Submittals: Submit at least 14 calendar days before scheduled start, and obtain approval of the syllabus and materials for each phase before beginning that phase.

1. Course schedule.
2. Syllabus for each phase of training, including agenda, defined objectives, and detailed description of the subject for each session.
3. Other training materials.

C. Study materials: Mechanical system and DDC Operation and Maintenance Manuals. Provide one set for each trainee and two sets for archive at site.

1. Furnish audio-visual equipment and provide all other materials and supplies required.

D. Training day: 8 hours of classroom, lab, or on-site instruction, including two 15-minute breaks and excluding lunch time, Monday through Friday. Total hours: No fewer than 259.

E. Trainees:

1. Assume a high school education.
2. Familiar with HVAC systems
3. Number: No more than 5.
4. Provide training to 3 shifts of workers, except only 1 shift of Supervisors, and offer makeup training.

F. Training goals:

1. Maintenance personnel are responsible for troubleshooting and replacing defective devices. They need to know locations of system components and the procedures to maintain system and components.
2. Service Center personnel are responsible 24 hours a day for responding to alarm conditions. They need to be able to navigate among the graphic screens and respond to each type of alarm.
3. Supervisors are responsible for troubleshooting and for generating reports such as Excel in graph formats. They need to have an overview of the system components and system architecture of the communication network.

G. DDC Maintenance Training Phase 1: The first class shall be taught for 3 consecutive training days, at least 2 weeks before the scheduled commissioning of equipment, in a facility provided by the Government. Provide classroom training including hands-on operation of digital controllers similar to the new system controllers, using the 5 notebook computers. On completion of this Phase, each student should be able to perform elementary operations and describe the general hardware architecture and the functions of the system. Course shall include but not be limited to:

1. Theory of operation.
2. Hardware architecture and configuration.
3. Operation of system.
4. Operator commands, change setpoints, override schedules, and related topics.
5. Control sequence programming.
6. Data base entry.
7. Reports and logs.
8. Alarm reports.
9. Diagnostics.
10. Reinstall as-built program on any DDC comtroller.
11. Configure and calibrate I/O devices.
12. Add a new controller to the system.

H. DDC Maintenance Training Phase 2: Teach in the field, using the operating equipment at the project site, for one day. Issue a password to each student at the beginning of each session, and provide hands-on training under the constant supervision of the instructor, using the 5 notebook computers. Content should duplicate the Phase 1 course as applied to the installed system. On completion of this Phase, students should be fully proficient in each system function.

I. DDC Service Center Training: The first class shall be taught for half a training day, at least 2 weeks before the scheduled Performance Verification Test , in a facility provided by the Government. Provide classroom training including hands-on operation of digital controllers similar to the new system controllers, using the 5 notebook computers. On completion of the course, service personnel should be able to navigate among the graphic screens and respond to each type of alarm.

J. DDC Supervisor Training: The first class shall be taught for one training day at least 2 weeks before the scheduled Performance Verification Test , in a facility provided by the Government. Provide classroom training including hands-on operation of digital controllers similar to the new system controllers, using the 5 notebook computers. Include at least:

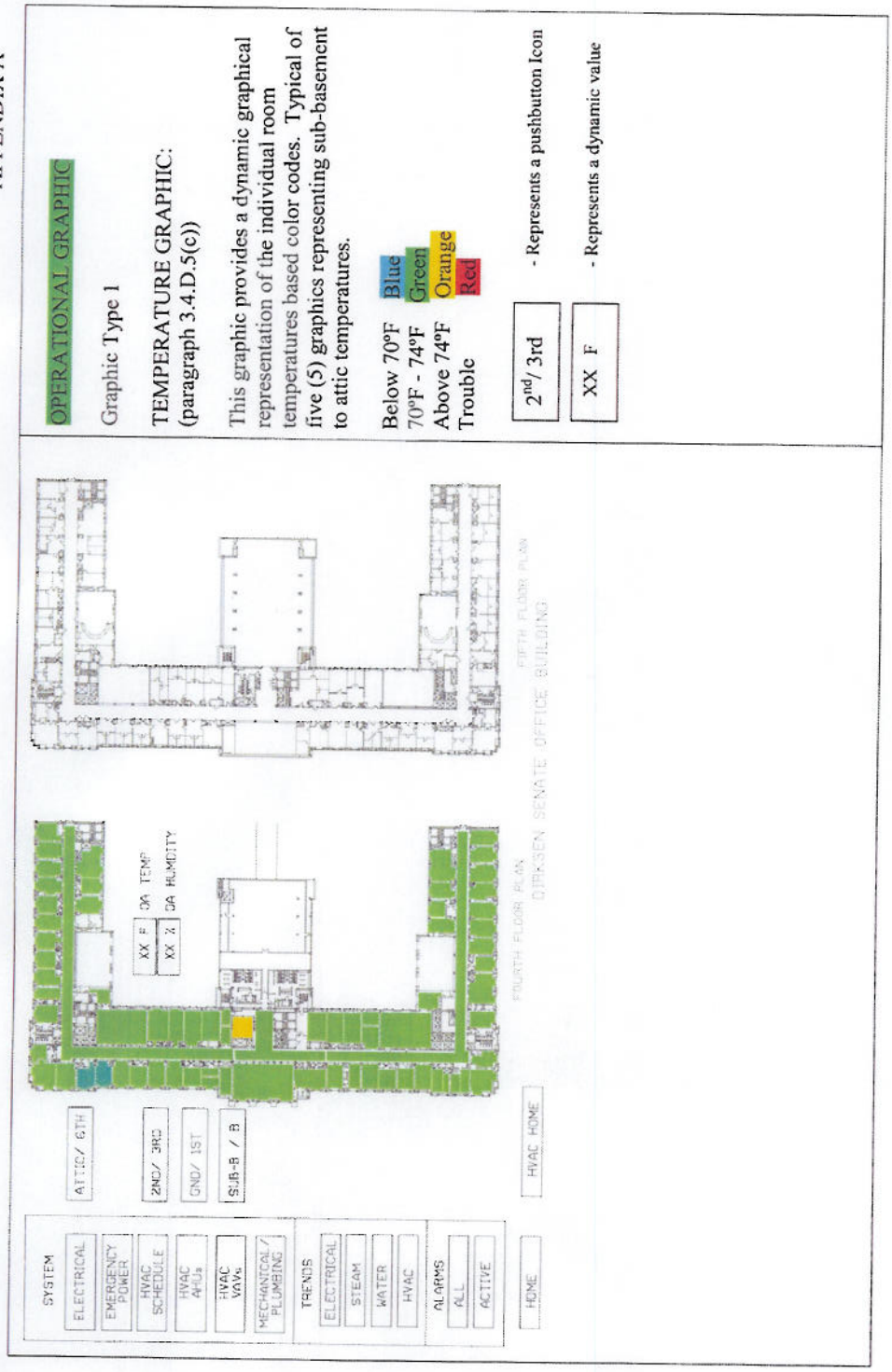
1. System language (program support environment and ladder logic).
2. System concepts.
3. Debugging methods.
4. Software and parameter alteration.

K. Incremental Training: As each AHU is turned over to the Architect, conduct a 2-hour session of Maintenance Phase 2 training and a 1-hour session of Service Center training for each shift.

END OF SECTION 15901

Appendix A follows section.

SPECIFICATION 15901
APPENDIX A



OPERATIONAL GRAPHIC

Graphic Type 1

TEMPERATURE GRAPHIC:
(paragraph 3.4.D.5(c))

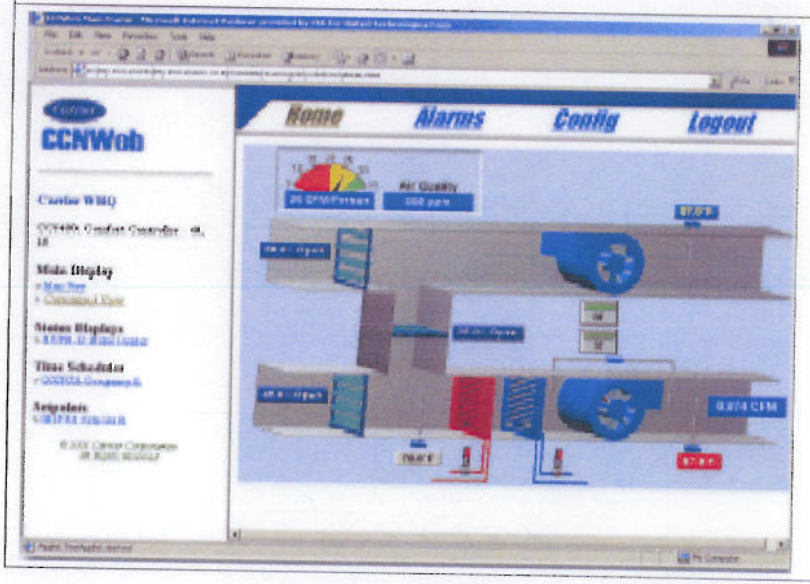
This graphic provides a dynamic graphical representation of the individual room temperatures based color codes. Typical of five (5) graphics representing sub-basement to attic temperatures.

Below 70°F	Blue
70°F - 74°F	Green
Above 74°F	Orange
Trouble	Red

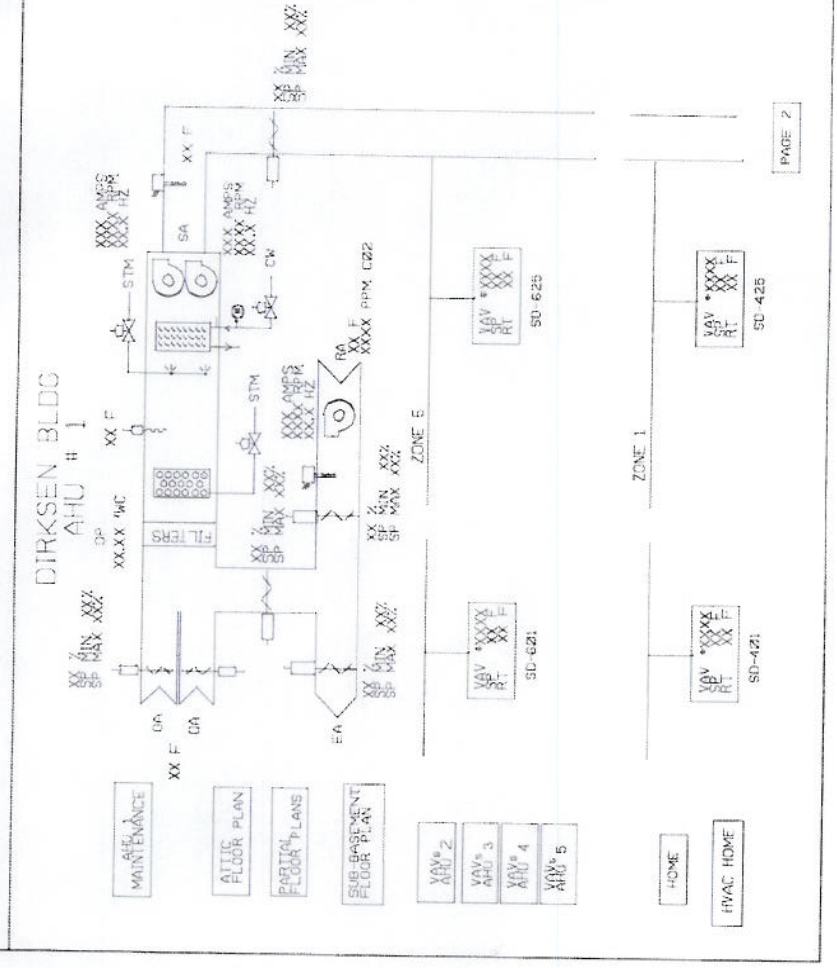
2nd/ 3rd - Represents a pushbutton Icon

XX F - Represents a dynamic value

1 of 8

This Graphic shows six (6) floor plans (basement through 6th floor) on a single graphic. The above floor graphic is reduced in size so that 6 floor plans fit on this graphic.	OPERATIONAL GRAPHIC Graphic Type 2 This is the "**HVAC HOME**" graphic. See Above for information. Typical of one (1) graphic.
	OPERATIONAL GRAPHIC Graphic Type 3 MECHANICAL SYSTEM GRAPHIC: (paragraph 3.4.D.5(e)) This graphic provides a dynamic graphical representation of the individual AHUs, steam to steam generators, etc.. Typical of forty-four (50) graphics representing sub-basement to attic temperatures.

SPECIFICATION 15901
APPENDIX A



MAINTENANCE GRAPHIC

Graphic Type 4

MECHANICAL SYSTEM GRAPHIC:
(paragraph 3.4.D.5(d))

This graphic provides a dynamic graphical representation of the individual AHUs and the VAVs served by the AHU. Typical of sixteen (16) graphics representing all AHUs with VAVs, (2 pages per AHU). The user can modify VAV setpoints.

Dynamic icons:

Motor running - Green

Motor stopped - Red

Device trouble or fault (yellow flashing)

Valve open/partial open - Green

Valve closed - Red

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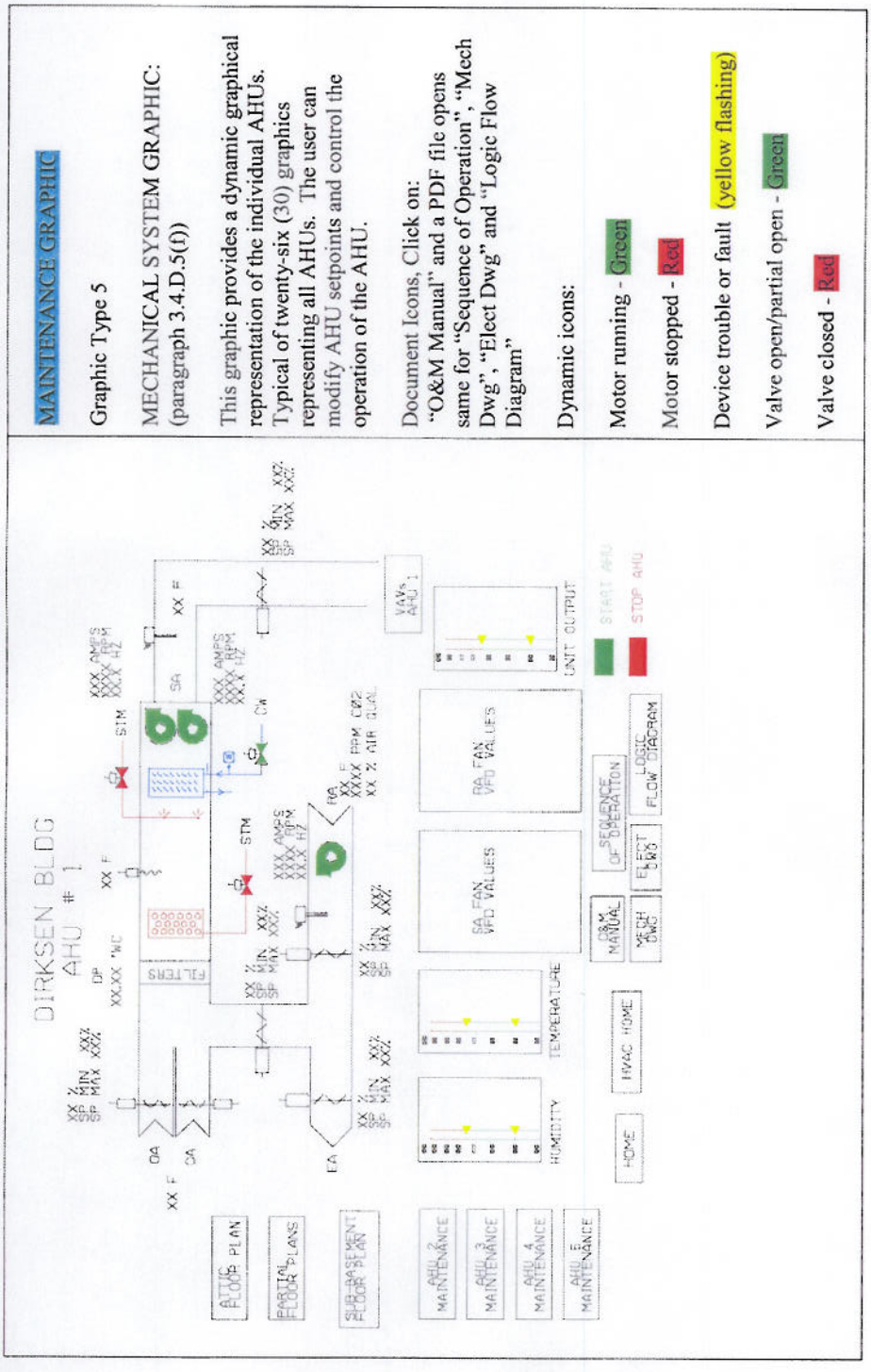
SPECIFICATION 15901
APPENDIX A



MAINTENANCE GRAPHIC

Graphic Type 5

MECHANICAL SYSTEM GRAPHIC:
(paragraph 3.4.D.5(f))

This graphic provides a dynamic graphical representation of the individual AHUs. Typical of twenty-six (30) graphics representing all AHUs. The user can modify AHU setpoints and control the operation of the AHU.

Document Icons, Click on:
"O&M Manual" and a PDF file opens same for "Sequence of Operation", "Mech Dwg", "Elect Dwg" and "Logic Flow Diagram"

Dynamic icons:

Motor running - Green

Motor stopped - Red

Device trouble or fault (yellow flashing)

Valve open/partial open - Green

Valve closed - Red

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SPECIFICATION 15901
APPENDIX A

MAINTENANCE GRAPHIC

Graphic Type 6

MECHANICAL SYSTEM GRAPHIC:
(paragraph 3.4.D.5(g))

This graphic provides a dynamic graphical representation of the individual AHUs and HVAC in the attic. Typical of three (3) graphics representing attic, sub-basement and partial floor plans for AHU on the ground floor, 2nd floor and 4th floor.

Clicking on an AHU icon will open the corresponding AHU graphic type 5 display.

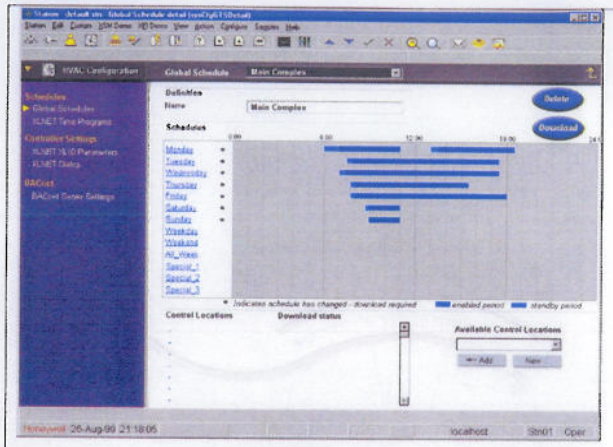
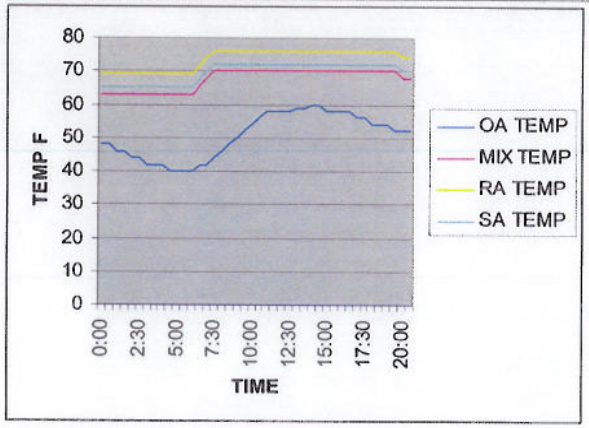
Dynamic icons:

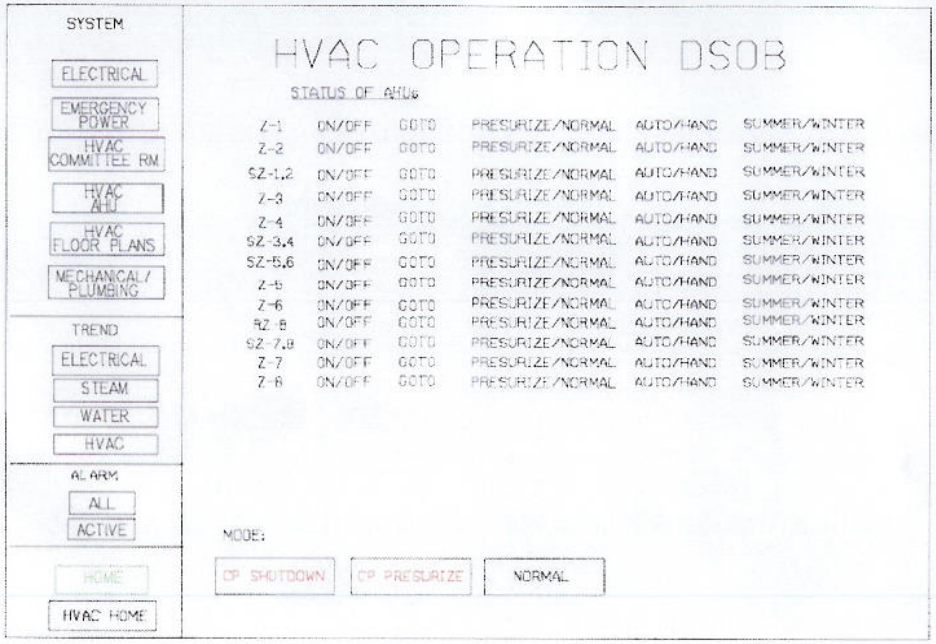
Motor running - Green

Motor stopped - Red

Device trouble or fault (yellow flashing)

5 of 8

	OPERATIONAL GRAPHIC Graphic Type 7 HVAC SYSTEM SCHEDULE GRAPHIC: (paragraph 2.8.8) This graphic provides a dynamic graphical representation of the individual AHUs. Typical of eighteen (18) graphics representing all AHUs. (1) – offices, (2) – general areas, (16) – one per committee room.
	OPERATIONAL GRAPHIC Graphic Type 8 HVAC TREND GRAPHIC: (paragraph 3.4.C) This graphic provides data vs. time plotted. Typical of four (4) trend graphics representing a single attic AHU temperatures, a single sub-basement AHU temperatures, all AHU CO2 levels and all AHU humidity.



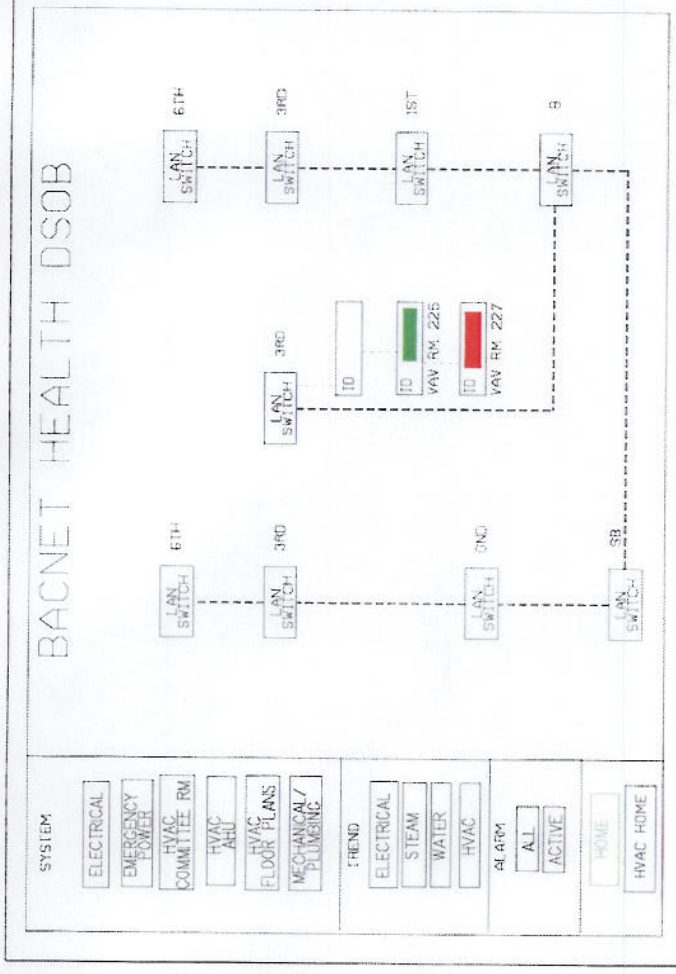
SUPERVISOR GRAPHIC

Graphic Type 9

HVAC OPERATION MODE GRAPHIC: (paragraph 3.4.D.5(h))

This graphic provides real time operational status on the AHUs. The Icons buttons at the button will allow a global operational change of all AHUs.

SPECIFICATION 15901
APPENDIX A



OPERATIONAL GRAPHIC

Graphic Type 10

BACNET HEALTH GRAPHIC:
(paragraph 3.4.D.5(i))

This graphic provides data about the operational status of the BACNET system. The 3rd floors LAN switch has been partial expanded to BACNET communication cards. Graphic with provide card location/area served and ID address.

Dynamic Icons:

Card 'OK' - Green

Card 'Fault' - Red

Card 'Trouble' - Yellow

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SECTION 16150 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power and control wiring for equipment.

1.2 RELATED SECTIONS

A. Equipment: All sections of specifications.

B. Motors: Section 15053.

C. Control wiring: Section 15900.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits, wires and cables, devices, and accessories as specified in other sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide power wiring from motor starters to each motor and its manual controlling device. Interlock and control wiring related to the automatic temperature control system for new mechanical equipment shall be provided under Section 15901. As work of this section, reconnect existing mechanical equipment.

1. Make flexible or liquid tight connections as specified in Section 16131, Conduits.

B. Certain equipment as indicated will be furnished with control panels and auxiliary control components. Mount the panels, furnish and install source wiring and disconnects, and completely connect controls and motors.

C. Provide source wiring, connections, and disconnects for mechanical heating, ventilating, and air conditioning (HVAC) equipment specified in Division 15.

1. Provide weathertight enclosures for disconnects for outdoor equipment.
2. Mount starters where required, and provide proper size overload protection.

D. Where a Division 15 section requires installation of equipment under supervision of equipment manufacturer's representative, coordinate electrical installation to cooperate with representative's requirements.

E. Provide power and control wiring for fire protection system alarm panels.

F. Provide wiring where required to time clocks provided as specified in automatic temperature controls sections.

END OF SECTION 16150

SECTION 16170 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disconnecting switches (disconnects).

B. Enclosed circuit breakers.

1.2 RELATED SECTIONS

A. Motors: Section 15053.

1.3 REFERENCES

A. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. UL 98: Enclosed and Dead-Front Switches.

1.4 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each type of disconnecting switch and circuit breaker.

1.5 QUALITY ASSURANCE

A. Comply with the following standards:

1. NEMA KS 1 Enclosed Switches.
2. UL 98.

PART 2 - PRODUCTS

2.1 DISCONNECTING SWITCHES (NONFUSIBLE)

A. Properly size switches for number of poles required for project conditions and to meet NEC requirements.

B. Switches shall be front-operated.

C. Current-carrying parts: Silver-plated copper.

D. Hinges: Noncurrent-carrying.

E. Switches shall be lockable in either open or closed position.

F. Type: Heavy-duty type on all voltages.

G. Enclosures: Indoors NEMA 250 Type 1; outdoors Type 3R with raintight hubs.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Separately enclosed circuit breakers, as indicated, in NEMA 250 Type 1 enclosure, manually-operated, trip-free from the handle, and provided with inverse-time, thermal-element overload protection and instantaneous magnetic short-circuit protection on all poles.

B. Breaker sizes, calibrations and interrupting capacity: Noted on the drawings. Breakers shall be calibrated for 50 degrees C ambient.

C. Type: Molded-case, NEMA AB1.

D. Operating handles shall clearly indicate the positions on, trip, and off.

E. Unit shall be labeled and listed for service entrance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnecting switches where indicated and as required for motor outlets or other equipment.

B. Furnish and install a disconnecting switch for each motor, as required by NEC, except where it is provided in a panelboard within sight and easy reach of the motor, and provide wiring and connections from source.

END OF SECTION 16170

SECTION 16266 - VARIABLE-SPEED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid-state, variable-speed motor controllers driving the supply fan motors of the air-handling units, and provided with the air-handling units.

B. Include filters, inductors, and isolation transformers if required to meet specified requirements, without addition to the contract sum.

1.2 RELATED SECTIONS

A. Air-handling units: Sections 15722 and 15723.

1.3 REFERENCES

A. IEEE Std 519: Harmonic Control in Electrical Power Systems.

1.4 PERFORMANCE REQUIREMENTS

A. The controllers shall introduce in the AC distribution system no voltage transients which exceed 250 millivolts at any frequency between 1,000 and 10,000 Herz.

1.5 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Include data on features, components, ratings, and performance of variable-speed controllers. Include the following:

1. Manufacturer's installation instructions.
2. Manufacturer's programming instructions for startup and for each user-adjustable program element.
3. Instructions for use of keypad and access to displays. Include a complete list of keypad displays and explanation of the meaning of each.
4. Complete list of diagnostic indications and messages, with explanation of each.

C. Shop drawings: Detail fabrication, internal and interconnecting wiring, and interface with connected equipment. Include dimensioned plan, elevation views, and details. Show access and clearance requirements. Differentiate between factory-installed and field-installed wiring and components.

1. Wiring diagrams: Include overcurrent protection and wire size information for the branch circuit which will supply power to each controller. Coordinate with control requirements.

a. Identify connections with terminal numbers and functions.

2. Control diagrams: Show interface between each controller and control system. Control diagram may be combined with wiring diagram if the building control system is clearly differentiated from the factory-provided wiring and components.
3. Coordination schedule: Identify each motor controlled by a variable-speed controller and show that characteristics of motor identified on approved submittals for the equipment are compatible with each proposed variable-speed controller.

D. Qualification data: For firms and persons specified in "Quality Assurance" below.

E. Test reports: Certified report of factory test of each controller.

F. Maintenance data: To include in the Operation and Maintenance Manuals specified in Division 1, including at least the items listed below, and operating instructions as required in "Product data" and "Shop drawings" above.

1. In addition to data for inclusion in O&M Manuals, provide three bound booklets of the information provided for the controllers.
2. Detailed installation, setup, operation, and programming instructions, including a list of all user-adjustable settings and their final field settings.
3. Troubleshooting and repair procedures including a list of recommended maintenance parts with catalog numbers and prices. In addition, identify parts which manufacturer recommends be kept in stock at the site.
4. Catalog data in the manual shall include:

a. Electrical ratings.
b. Dimensions.
c. Mounting arrangements.
d. Description of operation.
e. Complete list of features for each controller included in the project, and its performance characteristics and attributes.

G. Field test reports: Submit within one week of completing the tests required in Part 3 below. Include no less than the following:

1. Defects found and the methods used to correct them.
2. Statement that each controller and the installation comply with project requirements.
3. For each controller, a list of all programmed settings and their setpoints at the completion of installation.

H. Warranties: Special warranties specified below, executed to the Government.

1.6 QUALITY ASSURANCE

A. Provide manufacturer's most recent model of each type of controller.

B. Manufacturer's technician: Factory-trained, with at least two years' experience installing, starting up, and operating controllers of the types included in this project.

1.7 WARRANTY

A. Product certificates signed by manufacturer certifying that each product furnished meets the specified requirements, is compatible with and will operate reliably and accurately with the interfacing systems and equipment, and is ready for permanent operation.

B. Installer's certification that the installation and field tests are in compliance with the manufacturer's instructions and do not violate the manufacturer's warranty.

PART 2 - PRODUCTS

2.1 VARIABLE-SPEED MOTOR CONTROLLERS

A. General: Fully digital, solid-state, pulse-width modulation type, for positive speed control of 480-volt, 3-phase, 60-Herz, 1800-rpm NEMA Design B induction motors with the full load amperage capacities and nominal horsepower ratings indicated. Verify compatibility and suitability for each drive and motor on coordination schedule required in Part 1 above.

1. RS-485 and LonWorks communication cards. Controllers shall be able to communicate with ModBus and LonWorks as well as BACnet.
2. Designed for variable-torque, continuous centrifugal fan duty.
3. Sized so that each motor shall be capable of delivering at least the minimum torque required for starting its fan. In sizing, take into account the fan inertias and motor and fan speed ratios, as well as reasonable assumed drive losses.
4. Diode bridge rectifier section: Shall convert 480-VAC (plus 5 percent minus 9 percent), 3-phase, 60-Herz power to direct current. Silicon-controlled rectifiers are not acceptable.
5. Insulated-gate, bipolar transistor inverter section: Shall provide adjustable-frequency, 3-phase, AC output for control of the speed of the connected motor from 30 to 100 percent of nominal motor speed.
6. Inverter logic: Fully digital, microprocessor-based. Control logic power shall be isolated from the power circuits.

   a. User's keypad: Mounted in door.
   b. System parameters shall be stored in nonvolatile memory. Potentiometers or dipswitch settings are not acceptable.

7. Printed circuit boards shall be completely tested and burned-in before being assembled into the completed controller. The controller shall then be subjected to a preliminary functional test, eight hour burn-in, and computerized final test. The burn-in shall be at least 104 degrees F (40 degrees C), at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.
8. DC or AC line reactor to reduce the harmonics to the power line.

B. Line reactor: Three-phase, designed for harmonic service, air-gapped, recognized as component in UL E 116124.

1. Design maximum temperature rise: 115 degrees C.
2. Performance, ratings and tests:

   a. Inductance shall be measured under full load and shall be within ten percent above or below design value.
   b. Designed and thermally tested as described in IEEE C57.110, K factor rating for harmonic current tolerance. Tested to UL 508 standard with the current spectrum drawn by an actual adjustable drive.
   c. Line reactor inductance shall remain above 50 percent nominal (defined saturation point) for any overload up to 250 percent of rated current.
   d. Line reactor shall sustain no damage when subjected to up to 150 percent RMS current continuously for at least three minutes.

C. Enclosure: In accordance with NEMA ICS 6, Type 1 where installed indoors, Type 4X where installed outdoors.

D. Controllers shall be operable in an open-circuit mode (disconnected from their motors).

E. Bypass operation with controller:

1. Drive and bypass shall be combination tested for at least 22 KAIC series rating.
2. Include motor thermal overload circuit breaker protection while in bypass and drive operation.
3. Three-position selector switch to control the bypass contactor and the drive output contactor, mounted on the enclosure door.

   a. When in the "Normal" mode, the bypass contactor is open and the drive output contactor is closed.
   b. In the "Test" position both contactors are open.
   c. In the "Bypass" position, the drive output contactor is open, and the bypass contactor is closed.
   d. The drive output contactor shall also be open when a stop command is given, isolating the motor from the drive.
   e. Start/stop signals and safety interlocks will work in drive and bypass modes.

4. Door-interlocked thermal magnetic circuit breaker which will disconnect power supply to the drive and all internally mounted devices, with handle extending through the door and padlockable in the "Off" position.
5. Power factor: Controller shall provide a constant power factor no less than 0.95 at all operating speeds and loads.
6. Interface with building systems: Controller shall be fully compatible and coordinated with the building automatic temperature control system (ATC) and the building automation and control system.

a. Controller shall be capable of accepting a 4-20 mA signal from the HVAC control system to control speed setting.

7. Controller shall operate within the following limits without derating:

a. Operating temperature: 0 to 40 degrees C.
b. Altitude: to 1000 meters ASL.
c. Relative humidity: 0 to 95 percent without condensation.

8. Efficiency: No less than 95 percent at full load.
9. Total harmonic distortion: No more than 5 percent (general system application in accordance with IEEE Std 519.

F. Frequency control: With input of 480 volts, plus 5 to minus 9 percent, 3 phase, 60 Hz, output shall be 0 to 480 volts, 3 phase, 2 to 60 Hz.

G. Speed control modes: Auto or Hand, selected by the user on the door-mounted keypad.

1. Hand mode: Controller operates under control through the keypad.
2. Auto mode: Controller operates under control of the building automation and control system.
3. User-defined minimum and maximum speed settings shall limit motor speed under either Hand or Auto mode.

H. Controller features and characteristics:

1. Pilot lights: Shall indicate Power On when input power is available; Run when controller is supplying power to its connected motor; and Controller Tripped when controller has shut down because of a fault condition.
2. Keypad: For user-adjustable settings, with an LED digital display capable of indicating motor speed, true rms motor amps, all user-adjustable settings, and troubleshooting messages.
3. Carrier frequency: User-adjustable over its full range (no less than 3000 Hz to 8000 Hz).
4. Soft motor starting: Provided by user-adjustable current-limiting circuitry. Maximum starting current shall not exceed 200 percent of motor full load current.
5. Full-time motor current limit: User-adjustable from a minimum of 50 percent to 100 percent of controller full load output current.
6. Momentary power ride-through capacity: 6 cycles.
7. Controller shall run at a programmable preset speed if the input reference (4-20 mA or 2-10 V) should be lost.
8. It shall be possible to make operating parameter changes while the controller is running.
9. Tamper-resistance: Provide a means to secure user-adjustable settings against unauthorized use.
10. Controller shall be capable of starting into a turning motor.
11. Auto-restart: Shall restart the controller after a shutdown for any cause.
12. Speeds: Three, preset, user-adjustable, activated by 3 contact closures.

13. Field wiring connections: Provide terminal blocks. Identify connection points on wiring diagrams and at the terminal blocks.
14. Contacts: Dry contacts to provide independent signals to the building automation and control system, in addition to single-pole, double-throw contacts rated 10 amps at 120 volts AC for each of these conditions:

    a. Controller run.
    b. Controller ready.
    c. Controller fault.

15. Additional user-adjustable features:

    a. Minimum and maximum speed settings, which shall be in effect whether controller is in hand or auto mode:

        (1) Minimum 0 to 60 percent.
        (2) Maximum 45 to 100 percent.

    b. Acceleration and deceleration times: 0.1 to 600 seconds.
    c. Critical frequency rejection bands:

        (1) At least 3 bands.
        (2) Bandwidth: Approximately 2.5 percent of the total speed range.

    d. Carrier frequency: Adjustable from 3000 to 8000 Hz.
    e. Volts/hertz ratio patterns: Preset, and one fully user-definable.

16. Controller shall be capable of providing IR compensation to improve speed regulation of driven motor.

I. Protective features: Circuitry which shall initiate an orderly shutdown for protection against:

1. Incorrect phase sequence.
2. Single-phasing.
3. Overvoltage in excess of 10 percent of nominal voltage.
4. Undervoltage in excess of 15 percent of nominal voltage.
5. running overcurrent in excess of 110 percent for 60 seconds.
6. Instantaneous overcurrent in excess of 200 percent.
7. Surge voltage in excess of 1000 volts.
8. Overtemperature.
9. External fault trip.
10. Electronic thermal motor overload.

    a. This feature shall calculate a predicted motor winding temperature based on specific programmed parameters, and shall provide an orderly shutdown when the calculated thermal capabilities of the connected motor are exceeded.

b. Output power circuit: Designed so that a single-phase fault to ground or three-phase short circuit will not damage the components of the controller. Design shall not use fast-acting semi-conductor output fuses.

J. Troubleshooting features: For each drive, with alphanumeric display or indicator lights.

1. Overvoltage.
2. Undervoltage.
3. Instantaneous overcurrent.
4. Overload shutdown.
5. Fault/trip.
6. Control logic failure.
7. Overtemperature.
8. Full-time current limit operation.
9. System protection light: Shall indicate that the system has shut down and will recover when conditions return to normal.
10. AC power on.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide installation instructions and wiring diagrams at the site at the time of installation and at the time of inspection, testing, and startup.

3.2 INSTALLATION

A. Install controllers in accordance with manufacturer's recommendations and under the supervision of the manufacturer's technician.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's technician shall perform each of the following tasks.

B. Start up the controllers.

C. Inspect the drive and connected power control wiring.

D. Inspect the programming of all parameters including user-adjustable parameters.

E. Systematically check out controller performance.

F. Make final adjustments.

G. On completion of startup procedures, and after the interfacing systems and equipment have been energized, test each controller and demonstrate its compliance with all contract requirements.

1. Correct deficiencies identified by tests and prepare controllers for retesting.
2. Perform additional tests as necessary to show that deficiencies have been corrected.
3. Submit written record as required in "Submittals" in Part 1 above.

3.4 DEMONSTRATION AND INSTRUCTION

A. The manufacturer's technician shall provide eight hours of instruction to the Government's operating staff on operating, maintaining, troubleshooting, and repair or each type and size of controller included in the project. Coordinate the schedule of classes described below with the Architect.

B. The Architect will provide suitable on-site classroom facilities for the instruction, and will arrange for attendance by the designated employees.

C. Instruction shall include use of a demonstration controller and motor. Furnish demonstration controller and motor identical in design and operation to one of each provided as work of this contract, except that it shall operate on 120-volt, single-phase power.

D. Provide class curriculum and proposed materials for review and approval no less than one week before the classes. Include handouts based on Operating and Maintenance Manuals.

E. Approximately one hour of this time shall be devoted to Air Conditioning Shop employees. Instruction shall include at least:

1. Brief overview of general controller principles.
2. Controller operation.
3. Troubleshooting indicators.
4. Routine maintenance.
5. "Hands-on" instruction on the demonstration controller and motor.

F. The remainder of the instruction time shall be devoted to Electrical Shop employees. Instruction shall include at least:

1. Test equipment.
2. Test procedures.
3. Use of troubleshooting indicators to identify failed components.

   a. Simulate fault conditions on the demonstration controller and motor, and use those indications to illustrate troubleshooting procedures.

4. Procedures for safely removing and reinstalling failed sub-assemblies.

END OF SECTION 16266

SECTION 16421 - MOTOR STARTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Motor starters.

1.2 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Motor Starters.

C. Shop drawings shall show complete dimensions of complete assembled unit with accessories.

1. Provide composite wiring diagram showing all interlocking and control wiring.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Provide magnetic starter and combination circuit breaker and magnetic motor starter switch where indicated on the drawings. Starter shall be supplied in an enclosure suitable for its location, minimum NEMA 250 Type 1. Controller and starter serving remotely controlled motor shall have hand/off/automatic (HOA) selector switch on the starter cover.

B. Motor starters shall be across-the-line magnetic type, rated in accordance with NEMA Standards, sizes and horsepower ratings. Starter contacts shall be double-break silver alloy type, replaceable without removing power wiring or removing the starter from its mounting. Starter coils shall be 120-V, replaceable from the front without removing the starter from its mounting. Overload relays shall be melting alloy type with reset button. Thermal units shall be one-piece construction and interchangeable. Thermal units must be in place to operate starter.

1. Phase protection: Against phase loss and phase reversal, with automatic reset.

C. Provide each station with normally open and normally closed auxiliary contacts, Hand-Off-Automatic selector switches, and green running pilot lights. Provide control transformer with primary voltage as required with 120-V secondary voltage and with suitable protection for each starter.

D. Provide all necessary auxiliary interlock contacts required by temperature control equipment.

E. Manual motor starting switch: Provide single- or two-pole as required, with overload relays. Switch shall be surface-mounted, and shall have proper cover plates to suit the mounting.

Where noted on drawings or specified, switches shall be equipped with pilot lights and engraved designation plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount on a steel mounting plate securely attached to the wall or to independently supported structural channels.

B. Provide wiring as indicated on the drawings.

C. Provide magnetic motor starters for all equipment unless otherwise specified. Mount starters, auxiliary contacts required, and automatic control devices provided with equipment, except those which are already mounted on the equipment, fully wired and connected. Wiring diagrams will be provided under the Section requiring the equipment.

D. Provide starters with the proper size overload relays.

E. Check the size of the overload, and change as required, after the HVAC systems have been adjusted and balanced as specified in Section 15950, Testing, Adjusting, and Balancing.

END OF SECTION 16421

SECTION 16441 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Circuit breaker panelboards.

1.2 REFERENCES

A. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

B. NEMA PB 1, Panelboards.

C. NEMA PB 1.1, Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

D. UL 50, Enclosures for Electrical Equipment.

E. UL 67, Panelboards.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Shop drawings: Panelboards, with dimensioned plans, sections, and elevations. Show tabulations of installed devices, features, and voltage rating. Include:

1. Bus configuration and current ratings.
2. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
3. Wiring diagrams for power and control, differentiating between manufacturer-installed and field-installed wiring.

C. Product data: Each type of panelboard, accessory item, and component.

D. Test reports: As a minimum, date of completion of specified field quality control tests for each panelboard.

1.4 EXTRA MATERIALS

A. Furnish spare breakers for panelboards as indicated in schedule on drawings.

PART 2 - PRODUCTS

2.1 PANELBOARDS, GENERAL

A. UL listing: UL 67, listed and labeled.

B. Integrated equipment short circuit rating: Each panelboard, as a complete unit, shall have a short circuit rating equal to or greater than the integrated equipment rating shown or scheduled on the drawings.

1. Rating shall be established by testing in accordance with UL 67, with the overcurrent devices mounted in the panelboard. Make short circuit tests on the overcurrent devices and on the panelboard structure simultaneously, by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. The source shall be capable of supplying specified panelboard short circuit current or greater.
2. Testing of overcurrent devices only while individually mounted is not acceptable. Testing the bus structure by applying a fixed fault to the bus structure alone is not acceptable.
3. Mark each panelboard with its maximum short circuit current rating at the supply voltage.

C. Enclosures: Flush or surface-mounted as indicated, NEMA PB 1, Type 1, UL 50, galvanized steel.

2.2 CIRCUIT BREAKER PANELBOARDS

A. Factory-assembled complete with breakers.

B. Cabinets and fronts: Minimum 20 inches wide, wiring gutter space in accordance with UL 67, with minimum four-inch width on every side.

1. Door: Required for sizes up to and including 600 amps.

a. Door-in-door construction, secured with a single latch, with outer door covering the gutter.
b. Lock: Flush, cylinder tumbler type, with catch and spring-loaded stainless steel door pull. All panelboards shall be keyed alike. Provide two keys for each panelboard.
c. Hinges: Steel, completely concealed.
d. Provide a metal frame with clear plastic cover on the inside of the door, for the circuit directory.

C. Circuit breakers: UL 489; voltage, continuous current rating, and interrupting rating as indicated on the drawings; bolt-on, thermal-magnetic, molded case type with trip rating permanently indicated on the breaker.

1. Breakers shall be 1-, 2- or 3-pole, with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers.
2. Operating mechanism: Overcenter, trip-free, toggle-type with quick-make, quick-break action. Handles shall have "ON", "OFF" and "TRIPPED" positions.
3. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware or disturbing adjacent units, bars or branch circuit connections.

4. Where indicated on the drawings, provide standard main breakers, or lugs.

D. Bussing assembly and temperature rise: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule, established by heat rise tests conducted in accordance with UL 67.

1. Conductor dimensions shall not be accepted in lieu of actual heat tests.
2. Current-carrying parts of the bus structure shall be silver-plated copper.
3. Provide a separate ground bus with screw terminals for branch wiring and feed-through lugs as indicated on the drawings.

E. Distribution panelboards: Distribution panelboard shall be capable of accepting up to 1200-amp branch breakers. Current characteristics shall be as scheduled on the drawings.

F. Lighting and appliance panelboards: Maximum branch breaker amperage shall be 125 amp.

1. Branch breakers serving exit lights, fire alarm, clocks, and telephone equipment shall be provided with handle blocking devices which shall prevent accidental operation but not prevent tripping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach panelboards to the wall where indicated on the drawings. Install in accordance with NEMA PB 1.1 and manufacturer's written installation instructions.

B. Frame and mount printed schedule of circuits indicating type and location of equipment outlets on each circuit.

C. Wiring in gutters: Arrange conductors into groups, and bundle and wrap with wire ties.

3.2 CONNECTIONS

A. Connect panelboards and components to wiring and to ground as indicated.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Identify field-installed wiring and components as specified in Basic Electrical Materials and Methods.

B. Label each panelboard with engraved nameplate.

3.4 FIELD QUALITY CONTROL

A. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.

B. Make continuity tests of each circuit.

3.5 CLEANING

A. Clean interior and exterior of panelboards.

B. Refinish painted surfaces damaged during construction to match the rest of the panelboard.

END OF SECTION 16441

SECTION 16460 - TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dry-type transformers

1.2 REFERENCES

A. NEMA TP 1: Guide for Determining Energy Efficiency for Distribution Transformers.

B. UL 1446: Test Procedures for Electrical Insulation Systems.

1.3 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: Each transformer, complete with details.

C. Certifications:

1. Specified sound levels.
2. Compliance with NEMA TP1 for energy efficiency.

PART 2 - PRODUCTS

2.1 TRANSFORMERS, GENERAL

A. Factory-assembled and -tested, air-cooled units of types specified, of size, phase, and voltage ratings indicated on the drawings, designed for 60-Hz service, Energy Efficient type in compliance with NEMA TP1.

2.2 DRIVE ISOLATION TRANSFORMERS

A. Insulation systems:

1. Class 220 insulation in accordance with UL 1446, 80-degree C rise.
2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient.
3. Insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM D 635.

B. Core and coil assemblies:

1. Transformer core shall be constructed with high-grade, nonaging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation

point. The transformer core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction.

2. The core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads. Taps shall be two steps above and four steps below nominal voltage in 2.5 percent increments.

C. Enclosure: Steel, equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.

1. Construction: Ventilated, NEMA 2, drip-proof, with lifting holes. Ventilation openings shall be protected against falling dirt.

D. Finish: ANSI 61 color weather-resistant enamel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Mount directly on floor, as shown on the drawings.

B. Ground neutrals of dry type transformers as required by NEC (NFPA 70).

3.2 INSTALLING TRANSFORMER

A. Protect against overload on the primary side by circuit breakers as indicated.

B. Install transformers on vibration isolator pads.

C. Make immediate connections to and from transformers through flexible metal conduit.

3.3 ADJUSTING AND CLEANING

A. Refinish painted surfaces damaged during construction to match the rest of the equipment.

B. Adjust taps to provide optimum voltage conditions at utilization equipment.

END OF SECTION 16460

SECTION 16510 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting fixtures, including lamps, ballasts, and accessories.

1.2 SUBMITTALS

A. General: Comply with Section 01000.

B. Product data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, photometric performance, lamps, and ballasts.

C. Shop drawings: Show complete dimensions of complete assembled unit with accessories.

D. Ballast test: Report conformance with maximum 90 degrees C case temperature.

E. Schedule:

1. Must be approved before any fixture is ordered.
2. Include, in detail, the following items:

Type
Wattage
Voltage
Efficiency
Suspension
Glassware
Finished Diameters
Lamps
Remarks
Appurtenances

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver glassware and lamps in their original cartons, clearly labeled.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Fixtures shall be complete with sockets, casings, fittings, holders, shades, glassware, lamps, and appurtenances, wired and completely assembled.

B. Fixtures, materials, methods of construction, forms, gauge of metals, fittings, and appurtenances, shall be in accordance with these specifications and with materials, construction, and performance of the specified fixtures.

C. Material shall be of the best grade and approved manufacturing standards, and workmanship shall be first class, such as shall produce fixtures of a high character and fine finish.

D. Sockets shall be properly and securely positioned so that the filament of the size and type lamps specified, when installed in such sockets, will be in correct relation to the center of the fixture. Sockets shall be tested and labeled by an independent, nationally recognized testing and laboratory authority. Fluorescent sockets shall be through-slot type.

E. Metal boxes and metal parts shall be constructed by the manufacturer for use with the fixtures and shall be of code grade thickness with joints welded or mechanically fastened. Provisions for support of reflectors, lenses and lamps shall be in strict accordance with the optical details and requirements of the combinations specified.

F. Fixtures shall be in accordance with local, state, and national codes.

G. Tentative finishes for certain fixtures are specified hereinafter, but the Architect reserves the right to specify colors and finishes to meet special requirements at the building.

H. Lenses and diffusers shall be of the material, shape, design, type, manufacture and efficiency scheduled and specified. Prismatic glass parts shall be exactly as specified for optical details, lighting characteristics, results and tests.

1. Plastic lighting diffusers shall be 100 percent virgin acrylic.

I. Lamps: Standard products of the manufacturer. Lumen output and life of lamps shall be in all respects equivalent to those specified.

J. Fluorescent lamps shall be rapid start F32W 41K T-8 lamps, unless otherwise specified.

K. Fluorescent fixtures shall have two-lamp hybrid ballasts wherever possible. Single-lamp ballasts shall be kept to a minimum. Ballasts shall be tested and labeled by an independent, nationally recognized testing and labeling authority, high-power-factor, energy-saving type with sound rating "A". Each ballast shall be internally protected with a resettable thermal protector to conform to UL requirements for Type P ballasts. Where 32-watt fluorescent lamps are used, the ballasts and lamps shall be rapid-start type. Where fluorescent lamps other than 32 watt size are used, provide hpf, trigger-start ballasts. Ballasts shall not exceed 90 degrees C case temperature in continuous operation for fixture installations matching job conditions.

L. Where outlets are shown on drawings, the type of fixture required is designated by a letter. These letters are explained and specified in the schedule. Fixtures furnished shall be in accordance with these descriptions and specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before ordering the light fixtures, verify the specified voltage with the voltage shown on the drawings to insure the correct voltage is supplied.

3.2 INSTALLATION

A. Furnish and install a complete lighting fixture for every outlet indicated on the drawings so that every outlet shall be properly provided with a suitable fixture of type specified, of wattage indicated.

B. Fixture wire shall be tested and labeled for fixture use. Fixture wiring for fluorescent fixtures and branch circuit wiring in fluorescent fixture channels shall be type THHN.

C. Each fixture shall be completely equipped with lamps of the size, type, wattage and shape indicated and specified. Lamps shall be of the proper voltage for the building.

D. Furnish fixtures in the quantities, sizes and types indicated on drawings.

E. Surface-mounted and stem-suspended fluorescent fixtures shall be supported from the concrete or steel structure above with 0.25-inch (6-mm) rods fastened to joists with beam clamps or hooks embedded in concrete in an approved manner. Provide channels between joists where necessary to obtain proper spacings for supports. Securely bolt or weld channels to joists.

1. Install double nuts on rods.
2. Where it is necessary for a fixture to be installed directly below an air duct, install two hanger rods, one on each side of the duct, bolted to a channel or angle suspended from the hangers under the duct, and support the fixtures from the suspended channel or angle.
3. Provide two supports for each individual fluorescent fixture, one at each end of fixture. In continuous rows, install an additional support at each joint.
4. Surface-mounted fixtures mounted on low-density ceilings shall be provided with spacers where required.

END OF SECTION 16510